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ABSTRACT

Results of a study of 1980 university entrance requirements in South Africa are presented, with attention to (1) the question of whether the minimum score on the Standard 10 examination should be raised and (2) the possibility of differential entrance requirements and channeling of students to various kinds of tertiary education. Previous research in South Africa, including studies of success at universities and particularly during the freshman year, is also reviewed. The study sample consisted of 16 universities, 9 technikons, 35 teacher training colleges, and 80 nursing colleges. Tertiary institutions in the Republic of South Africa and four independent states were evaluated: Transkei, Bophuthatswana, Venda, and Ciskei. Statistical analysis included: CHAID and XAID computer programs; regression, multivariate, and discriminant analysis; principal component analysis; and correspondence analysis. Scatter diagrams and tables display the findings of each technique. It was found that if the minimum examination score were raised 100 points, 828 of the 6,284 students would not have obtained university entrance, although 19% of those 828 students were in fact successful in their university study. Additional findings are provided, along with explanations of the statistical techniques. A summary in both English and Afrikaans is included. (SW)

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Report WS-32 1985

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Investigation into differential entrance requirements for tertiary educational institutions

An abridged version of Report WS-31

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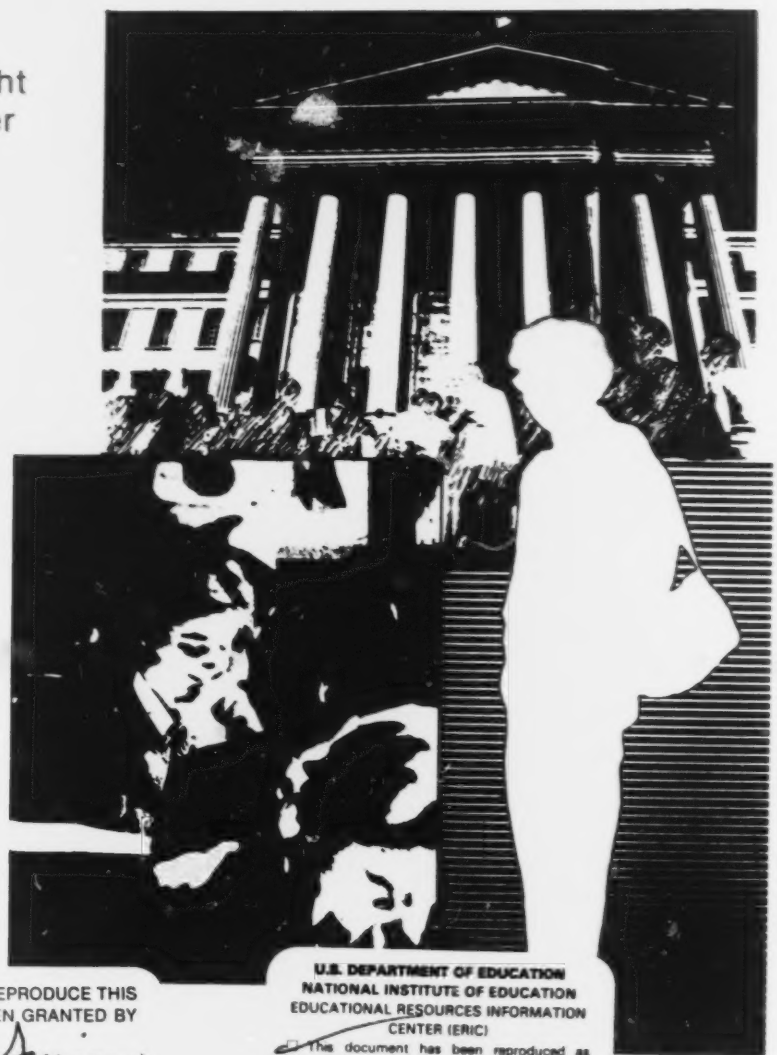

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PREFACE

The entrance requirements of tertiary institutions are currently being given top priority by policy makers and planners.

This report is a condensed version of Report WS-31 under the same title and of which only a limited number were distributed. The project resulted from research undertaken by the HSRC at the request of the Joint Matriculation Board within the framework of the HSRC Educational Research Programme and constituted an extension of the original request of the Committee of University Principals (to the JMB) that consideration be given to the raising of university entrance requirements. In the research attention was paid not only to the implications of a possible increase in the minimum required Standard 10 aggregate, but also to the possibility of introducing differential entrance requirements for different university study fields on the basis of achievement in certain combinations of school subjects. In addition to the above the possible channelling of candidates into other forms of tertiary education on the basis of Standard 10 examination results was investigated.

Thanks are due to everyone concerned (tertiary institutions, education departments and examining bodies) for co-operating in the provision of the required information. It is trusted that the information in this report will be useful to them as well as to other interested persons, and that the career planning and development of future generations of pupils and students will also benefit.

J. G. Garbers.

J.G. GARBERS
PRESIDENT

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OPSOMMING

Die probleemstelling en agtergrond van die ondersoek word in hoofstuk 1 geskets. Na aanleiding van die bekommernis van die Komitee van Universiteitshoofde (KUH) oor die groot druiping en uitsakking van studente op universiteit het die KUH by die Gemeenskaplike Matrikulasieraad (GMR) aanbeveel dat strenger kriteria vir universiteitstoelating aangelê word, onder meer deur die verhoging van die vereiste minimum skoolgroottotaal van 950 tot 1 050 punte. Op grond daarvan het die GMR die Raad vir Geesteswetenskaplike Navorsing (RGN) versoek om die aangeleentheid te ondersoek. Die eksplisiete versoek was om op die moontlikheid van differensiële toelatingsvereistes in te gaan met inagneming van die moontlike kanalisering van studente vanaf skool na die verskillende vorms van tersiêre onderwys.

In hoofstuk 2 word 'n beknopte oorsig gegee van navorsing wat tevore in Suid-Afrika in verband met die onderhawige probleem gedoen is. 'n Aantal navorsingsondersoeke in verband met studiesukses aan universiteite (veral in die eerste studiejaar) word beskou. Relatief min navorsing is nog gedoen oor die sukses van studente aan technikons, onderwyskolleges en opleidingskolleges vir verpleegkundiges. Relevante navorsing hieroor word egter vermeld. Met die oog op die RGN-ondersoek is daar telkens veral gelet op die parameters wat geredelik beskikbaar is en wat geblyk het 'n verband met sukses in tersiêre studie te toon.

In hoofstuk 3 word die rasionaal, beplanning, uitvoering en beperkende faktore van die ondersoek bespreek. Die ondersoek het die volgende vorms van tersiêre-onderwysinrigtings betrek, naamlik universiteite, technikons, onderwyskolleges en opleidingskolleges vir verpleegkundiges. Nie alleen is die tersiêre-onderwysinrigtings van die RSA betrek nie, maar op uitnodiging ook dié van die vier onafhanklike state Transkei, Bophuthatswana, Venda en Ciskei. Die afgrensing van die ondersoekgroep word bespreek, onder andere oorwegings by die keuse van 1980 as die jaar van eerste inskrywing. Daarbenewens word die grade en diplomas wat vir die ondersoek betrek is en die verskillende parameters waaroor inligting bekom is, beskou en bespreek. Die skakeling met die tersiêre-onderwysinrigtings, onderwysdepartemente en eksaminerende liggame en die insameling van die inligting word geskets. Ten slotte word die werklike realisasie van die steekproef in tabelvorm weergegee.

Hoofstuk 4 bevat die statistiese analises wat uitgevoer is. Verskeie statistiese tegnieke is aangewend en met behulp daarvan is vasgestel welke veranderlikes 'n betekenisvolle rol speel in die verklaring van die variasie in suksesvolle tersiêre studie. Dit blyk dat benewens die skoolgroottotaal in die standerd 10-eksamen, bepaalde kombinasies van skoolvakke eweneens 'n belangrike bydrae tot die verklaring van studiesukses maak. Daarbenewens word wesentlike verskille tussen tersiêre-onderwysinrigtings en tussen eksaminerende liggame ten opsigte van studieprestasie uitgewys. In terme van belangrike skoolprestasieparameters word moontlike kriteria vir differensiële toelating bespreek.

In die laaste hoofstuk word die ondersoek in konteks geplaas. Die moontlikheid van differensiële toelatingsvereistes tot tersiêre studie word aangeraak. Ten slotte word die effek van die verhoging van die vereiste minimum skoolgroottotaal vir matrikulasie of matrikulasievrystelling bespreek sowel as die moontlikheid van kanalisering van kandidate na ander tersiêre-onderwysinrigtings as die universiteit.

SUMMARY

The statement of the problem and the background in respect of the investigation are outlined in Chapter 1. Owing to the concern of the Committee of University Principals (CUP) regarding the high rate of failure and the high dropout rate of students at university, the CUP recommended to the Joint Matriculation Board (JMB) that more stringent criteria be applied for university entrance, for example by raising the required minimum school aggregate mark from 950 to 1 050. On the basis of this recommendation the JMB requested the Human Sciences Research Council (HSRC) to investigate the matter. More specifically the request was for the HSRC to investigate the possibility of differential entrance requirements while bearing in mind the possible channelling of students from school to the various forms of tertiary education.

In Chapter 2 a synopsis is given of research already done in South Africa on this problem. Several research investigations on study success at universities (particularly during the first year of study) are considered. Relatively little research has been done with regard to the success of students at technikons, teachers' training colleges and training colleges for nurses. Relevant research in this respect is however mentioned. With a view to the HSRC investigation, particular emphasis was placed on the parameters that are readily available and appear to be associated with successful tertiary study.

In Chapter 3 the underlying rationale, planning, carrying out and limiting factors of the investigation are discussed. In the investigation the following tertiary education institutions were considered: universities, technikons, teachers' training colleges and training colleges for nurses. Not only the tertiary education institutions of the RSA but upon invitation also those of the four independent states, Transkei, Bophuthatswana, Venda and Ciskei, were included. The definition of the survey group is discussed, including the considerations leading to 1980 as the year of first registration. In addition the degrees and diplomas included in the investigation, as well as the various parameters for which information was obtained, are considered and explained. The liaison with the tertiary education institutions, departments of education and examining bodies and the way in which information was obtained, are sketched. Finally the realization of the sample is given in four tables.

Chapter 4 deals with the statistical analyses that were carried out. Various statistical techniques were employed in order to establish which variables played a significant role in explaining the variation in successful tertiary study. It appears that apart from school aggregate in the Standard 10 examination, specific combinations of school subjects also contribute to the explanation of the variation in study success. In addition fundamental differences among tertiary education institutions and among examining bodies regarding study achievement are pointed out. Possible criteria for differential entrance requirements in terms of important school achievement parameters are discussed.

In the last chapter the investigation is placed in context. The possibility of differential entrance requirements for tertiary study is briefly discussed. In conclusion the effect of increasing the required minimum school aggregate for matriculation or matriculation exemption is discussed as well as the possible channelling of candidates to tertiary education institutions other than universities.

CHAPTER 1

STATEMENT OF THE PROBLEM AND RESEARCH REQUEST

1.1 STATEMENT OF THE PROBLEM

For some time now the standard of the requirements for university entrance has been a matter of concern to the Committee of University Principals (CUP). It appears that the percentage of the age group that qualifies for university entrance in a particular year is increasing. In 1974 the percentage of 18-year-old Whites who obtained university entrance was 28. Since then this figure has risen steadily and in 1980 it was almost 34 %. Despite the various auxiliary and students' advisory services introduced at universities, the failure rate at university, particularly among first-year students, remains alarmingly high.

On the basis of the results of a pilot investigation conducted by an ad hoc committee of the CUP in respect of the White universities of the CUP and supported by similar results obtained in a sample survey in respect of the universities falling under the Committee of University Rectors (CUR), the CUP sent a written request to the Joint Matriculation Board (JMB) on 6 December 1982 that consideration be given to the following recommendations:

1. The requirements for matriculation exemption should be raised so that a smaller percentage of a given age group would qualify annually for university entrance. According to the CUP the ideal percentage for the RSA should be approximately 20.

2. This rise in standards (and the resultant decrease in the percentage of pupils obtaining matriculation exemption) should occur gradually.

3. As a first step the present minimum aggregate mark needed for matriculation exemption, namely 950 (± 45 % average), should be increased to 1 050 (50 % average) calculated on the current maximum that can be obtained per subject (without any bonus points being added).

4. When the proposed rise in the requirements for matriculation exemption has been achieved, follow-up studies should be undertaken and further rises implemented to whatever level appears to be necessary.

5. The matter should be regarded as urgent and arrangements made for the measures to be introduced with regard to the 1983 final examinations.

The CUP added that the proposed changes should be effected without prejudice to the subsidy income of the universities, which up to now has been based on student numbers.

The CUP also recommended that the universities themselves should give attention to the considerable difference in the success rate of students in the literature and arts field and that in the natural sciences and commerce fields. One possibility would be to introduce differential entrance requirements for the different fields.

In its consideration of the CUP's request, the JMB approved in principle the recommendation that the minimum requirements for university entrance should be raised, pointing out however that it was doubtful whether an increase merely in the aggregate required for matriculation or matriculation exemption would necessarily ensure a better selection for university entrance. They felt that with a view to more stringent selection for university entrance, attention should rather be paid to subject differentiation. Furthermore an increase in the required minimum aggregate from 950 to 1 050 marks might well bring about a substantial drop in the number of candidates obtaining university entrance annually. This minimum aggregate could also differ from one examining authority to another. The JMB also rejected the CUP's recommendation that the proposed rise in the minimum level be put into effect as early as the end of 1983. Since the senior secondary school phase formed a unit, provision should be made for a notice period of at least three years prior to the implementation of such a far-reaching change in the minimum requirements for matriculation and matriculation exemption.

1.2 REQUEST OF THE JMB TO THE HSRC

With a view to the proposed increase in the minimum entrance requirements for tertiary institutions, the JMB decided that

- a special committee consisting of Prof. J.P. de Lange (convener), Prof. C.G. Troskie and Mr H.A. Lambrechts be appointed to negotiate an investigation into the raising of the minimum entrance requirements for tertiary institutions in the RSA with the Human Sciences Research Council;
- the following tertiary and other educational institutions be involved in the investigation:
  - CUP and CUR universities
  - Technikons
  - Teacher training colleges
  - Nursing colleges
  - Committee of Heads of Education
  - Educational institutions for non-Whites, and
- in view of the urgency of the matter, 31 July 1984 be set as the deadline for the completion of the investigation.

In response to this request the HSRC decided in principle to conduct the desired research and to start by conducting two feasibility studies, namely:

* "Problems relating to the gap between school and tertiary education." The aim of this study was (a) to obtain an overall idea of research already conducted in respect of the transition from school to universities, technikons, teacher training colleges and nursing colleges, and (b) to obtain an indication from this of the parameters that play a role in this dynamic process.

* "Tentative empirical designs of investigations into differential prediction and channelling models for the transition from school to the different forms of tertiary education." The aim of this study was to search along statistical lines and in the light of relevant data for models in terms of which successful tertiary study could be satisfactorily described and which consequently could be used as channelling and prediction models.

Following this decision an internal work committee was appointed to compile a working document in which a provisional operationalization was set out and which served as a basis for discussion during a seminar.

1.3 DIVISION OF THE REPORT

In Chapter 2 a synopsis is given of research already conducted in respect of tertiary study. Chapter 3 deals with the planning and carrying out of the investigation. In Chapter 4 the obtained data are analyzed statistically and channelling models are investigated on the basis of the processed data. The last chapter (Chapter 5) provides an interpretation of the obtained results.

CHAPTER 2

A SYNOPSIS OF RESEARCH ALREADY CONDUCTED IN SOUTH AFRICA WITH REGARD TO THE PROBLEM UNDER DISCUSSION

2.1 INTRODUCTION

By way of orientation for the investigation, a broad literature study was undertaken of research already conducted with regard to the problem under discussion. Because of the specifically South African character of the problem it was decided to limit the literature study to South African research. In most of the earlier research conducted in this field in South Africa, attention was centred mainly on the first-year student and problems relating to his adaptation and progress at tertiary institutions. The effect of factors such as the following has already been studied:

* General background factors of the student including
  - the type of school attended;
  - sex;
  - age;
  - home language;
  - religious denomination, and
  - place of residence while at school.

* The student's school achievements including
  - the number of times that he failed at school;
  - the class in which the Standard 10 examination was passed;
  - mean Standard 10 percentage;
  - achievement in the Standard 10 examination in terms of matriculation exemption requirements;
  - achievement in specific subjects such as Afrikaans First Language, Afrikaans Second Language, English First Language, English Second Language, History, Latin, Physical Science, Biology and Mathematics.

* The educational and socio-economic background of the student.

* Particular intellectual qualities of the student such as IQ and reasoning ability.

* Particular non-intellectual qualities of the student such as aptitude, interest, study attitude and habits, motivation to achieve and self-assessment.

* Factors relating to the student's choice of university and study field.

* Social orientation at school.

* Participation in campus activities.

* General study conditions as experienced by the student.

* The effect on the student's progress of particular teaching strategies at the university.

Although all the above factors play or are able to play a role in the success of a student, it was decided to limit the literature study to research concerned specifically with the relation between successful or unsuccessful tertiary study and the student's achievement in the Standard 10 final examination. This after all is what the JMB was concerned with and it also involves mainly those parameters regarding which data can readily be obtained from the educational authorities and tertiary institutions.

2.2 RESEARCH ON SUCCESSFUL TERTIARY STUDY

On reviewing the investigations included in this report it should be borne in mind that they varied with regard to type of tertiary institution, date of investigation, size and representativeness of the survey group and research approach.

First an outline will be given of research undertaken in respect of successful university study. This will be followed by a synopsis of research on study success at technikons, teacher training colleges and nursing colleges.

2.2.1 Successful university study

The problem of failure at university is a long-standing one. As early as July 1938 Dr E.G. Malherbe in an address "Whither Matric?" pointed out that of the approximately 8 000 students enrolled at South African universities between 1930 and 1935, 3 185 (i.e. about 40 %) had failed their first year at university (Le Roux, 1976:1). These facts emerged from an investigation

that Drs. E.G. Malherbe and P.A.W. Cook completed in 1938 on the relation between the age of students at university entry, the class in which they had passed matric and their academic success at university (Malherbe and Cook, 1938). In 1957 Dr D.J. Gouws completed his thesis on the academic progress and adaptation of first-year students at the University of Pretoria during the period 1952 to 1955 (Gouws, 1961). A whole series of related studies at different universities were also undertaken by inter alios M.C.H. Sonnekus (1959), I.J. van Biljon (1961), N.J. Möller (1965), J.A. van Tonder (1969), A.G. Botha (1971), G.J. Smit (1971), D.M. Steyn (1971), W. v.d. M. Herholdt (1972), E.L. Conradie (1974), S.J. Wessels (1976) and P.K. Gounden (1977), all of whom also looked into the validity of matriculation examination marks as a predictor of success at university. They all found that success at school did to a fairly large degree extend to achievement at university, particularly first-year achievement.

In 1962 Prof. H.S. Steyn at the request of the JMB undertook a study on university success in five different study fields at the eight White residential universities in South Africa at the time (Steyn Report, 1963). At roughly the same time a team of researchers under Profs J.G. Garbers and J.A. van Aarde undertook a follow-up study at the University of Port Elizabeth of a generation of Standard 10 pupils in the Cape Province. In this study attention was paid inter alia to the first-year achievements of the students concerned at the different universities that they attended after matric/after completing their military service. The report on the above research appeared in 1972 (Garbers and Van Aarde, 1972).

In 1967 the CUP organized an interuniversity conference in Bloemfontein at which attention was focussed on university teaching, student activities and especially on the orientation of first-year students at university (Van Rensburg, 1967). The outcome of this conference was inter alia the establishment (or activation) of academically oriented students' advisory bureaux and bureaux for university teaching. These bureaux undertook considerable ad hoc research at local level which was not studied for the purposes of this report.

Particularly useful research of this nature that was studied, however, was Dr H.T. Gous' attempt to determine indices for the prediction of success or failure at the University of Pretoria (Gous, 1966). In 1978 the CUP organized a follow-up symposium in Pretoria on the theme "The transition from

school to university". The contribution of Drs G. Erens and J.B.Z. Louw during the symposium on the success rate of university students in South Africa has particular relevance for this investigation. Finally a CUP ad hoc committee under Profs C.F. Crouse and F.E. Steffens and Dr G. Erens undertook a study of the success rate of beginner first-year students enrolled for the B.A., B.Sc. and B.Comm. study fields at the five White residential universities in the Transvaal and in Natal during 1974 and 1975, with as criterion the period in which a three-year degree was obtained. This committee's recommendations to the CUP as reported in Chapter 1 duly gave rise via the JMB to this investigation.

2.2.2 Success at technikons

Little research has been done to date on the transition from school to technikon (or college for advanced technical education). Furthermore, three of the four earlier studies consulted in connection with this survey focused on the success rate of learner engineering technicians. In 1976 P.C. Smit did research on the engineering potential of learner engineering technicians at universities and colleges for advanced technical education. In 1982 this research was followed up by an investigation into school achievement as a predictor of the success of learner engineering technicians. J.M. Taylor, when constructing a selection instrument for learner engineering technicians, also concentrated on school achievement as a selection criterion (Taylor, 1978). The fourth investigation (Benade, 1979) was more extensive and included technikon study fields such as pharmaceutics, medical technology and microbiology.

2.2.3 Success at teacher training colleges

Although considerable attention has evidently already been paid to this subject on an ad hoc basis by the managements of the teacher training colleges, not much research has as yet been published as far as could be determined on the transition from school to teacher training college or on the study success of students at such colleges. From verbal enquiries it emerged however that the success rate at teacher training colleges was very high. (One spokesman mentioned a success rate of 95 % and higher.) Such research as has been undertaken and published on study at teacher training colleges has centred mainly on the question of the selection of prospective education students. Apart from the policies of the different education departments on the selection

and training of education students, reference can also be made to the research of Dr A.G. le Roux (1963), D.R. Mayo (1978), Dr N.J. van der Merwe (1979), Dr L.A. du T. Moolman (1981) and Dr J. Roux (1982), all of whom with the exception of Dr A.G. le Roux emphasized the importance of the Standard 10 final examination marks as a selection criterion, although Moolman added that they should not be regarded as the most important criterion.

2.2.4 Success at training colleges for nurses

Although all the nursing colleges have a selection procedure for prospective students, not much in the line of published research results appears to be available yet regarding the success rate at nursing colleges. The only investigation that could be traced was a rather unsuccessful investigation conducted by the NIPR at the Johannesburg General Hospital in 1980. A number of investigations have however been conducted at universities on the success rate of student nurses, including the investigations of Prof. M.C. van Huyssteen and Dr C.W. Fölscher (1978), A.A. Basson (1981) and P.C. Mearns (1980).

The success of the student nurse is evidently not determined only by achievement in the Standard 10 final examination. The student nurse enters the profession immediately after registration and this apparently plays an important role in his/her progress at the nursing college or university.

2.3 PREDICTORS OF STUDY SUCCESS AT TERTIARY LEVEL

In the light of the research dealt with in Paragraphs 2.2.1 to 2.2.4, a list of parameters that are readily available and appear to be associated with successful tertiary study will now be given. These parameters may be useful in the modelling of the present investigation.

Such parameters are:

* The sex of the student (cf. Gouws; Möller; Van Tonder; Steyn; Garbers and Faure; Gous; Mayo; Roux; Benade)
* Age at entry into tertiary study (cf. Malherbe and Cook; Gouws; Gous; Benade)

* Whether the student did military service before entry to tertiary study (cf. Garbers and Faure; Gous; Erens and Louw)

* The examination body under which the Standard 10 examination was written (cf. Malherbe and Cook; Möller; Steyn; Erens and Louw; Crouse, Erens and Steffens)

* The class in which the Standard 10 examination was passed (cf. Malherbe and Cook; Gouws; Steyn: Garbers and Faure; Gous; Erens and Louw; Crouse, Erens and Steffens; Smit; Benade; Mayo; Roux; Van der Merwe; Van Huyssteen and Fölscher; Basson; Mearns)

* The Standard 10 achievement in specific subjects including the mother tongue, second language, third language (Latin specifically), Mathematics, Physical Science, Biology, History, Bookkeeping, Commerce, Economics and Geography (cf. Gouws; Möller; Van Tonder; Steyn; Garbers and Faure; Gous; Crouse, Erens and Steffens; Smit; Benade; Van Huyssteen and Fölscher; Basson; Mearns)

* The study field followed at the tertiary institution (cf. Malherbe and Cook; Gouws; Steyn; Gous; Erens and Louw; Crouse, Erens and Steffens; Smit; Benade; Mayo; Roux; Van Huyssteen and Fölscher; Basson; Mearns)

* The success in the first study year as indicated inter alia by perseverance with the course, the number of subjects passed/failed and promotion to the second study year (cf. Malherbe and Cook; Steyn; Garbers and Faure; Gous; Smit; Mayo; Roux; Van Huyssteen and Fölscher; Basson; Mearns)

* The absence from examinations and discontinuation of courses (subjects) (cf. Gouws; Garbers and Faure; Mayo; Roux)

* Whether the degree/diploma was obtained within the minimum period or within the minimum period plus one or plus two years (cf. Steyn; Erens and Louw; Crouse, Erens and Steffens; Benade; Smit; Mearns)

* The mean mark obtained in the first-year subjects and in the final year subjects (cf. Malherbe and Cook; Crouse, Erens and Steffens; Benade; Mayo; Roux; Mearns).

CHAPTER 3

A BRIEF SURVEY OF THE PLANNING AND CARRYING OUT OF THE INVESTIGATION

3.1 INTRODUCTION

The aim of the investigations discussed in Chapter 2 was evidently to try to identify reliable predictors of successful tertiary study in terms of which entrance requirements could be determined for the different forms of tertiary study. Reliable predictors can be used to lay down distinctive entrance requirements for the different forms of tertiary institution on the one hand, and differentiated entrance requirements for the different study fields within each form of tertiary institution on the other hand.

The different forms of tertiary institution involed in the HSRC investigation were universities, technikons, teacher training colleges and nursing colleges. Not only tertiary institutions in the RSA were involved but, at the invitation of the HSRC, also the tertiary institutions in the four independent states: Transkei, Bophuthatswana, Venda and Ciskei.

3.2 THE TARGET GROUP

In determining the target group 1980 was chosen as the year of first registration at a tertiary institution. This was a logical choice, bearing in mind the fact that all the education departments had been examining on the basis of the differentiated syllabuses only since 1976 (the Directorate of Coloured Education from 1977) and the two year period of military service. The degree of success in the first three academic study years could therefore be evaluated over the minimum period (three years) and over the minimum period plus one year. Since 1980 the SAPSE system had also been fairly widely implemented at universities. In addition only full-time students were included in the target group.

3.2.1 Universities

With regard to universities, the following degrees and diplomas were included in the investigation:

B.A. (including B.A.(P.E.), B.A.(Languages), B.A.(Mus.), B.A.(Drama), B.A.(Comm.), B.A.(Law))

B.Comm. (including B.Econ., B.Econ.Sc., B.Accountancy, B.R.)

B.Sc.

B.Soc.Sc.

B.A.(Social Work), B.A.(SW) (the three-year degrees)

B.Admin

B.A.(Ed.), B.A.Paed.

B.Comm.(Ed.), B.Comm.Paed., B.Econ.(Ed.)

B.Sc.(Ed.), B.Sc.Paed.

B.Paed., B.Ped.

M.B.Ch.B., B.Med., B.Ch.D.

B.Sc.(Eng.), B.Eng.

B.Prim.Ed.

Pregraduate teaching diplomas

The SAPSE system was used to obtain a basis for comparing degrees with a minimum study period of more than three years and three-year degrees. The design of this system is such that the total of the SAPSE credit values of courses in a prescribed study year is approximately 1,00. Consequently the SAPSE credit values can be regarded as relative course weights for a particular study year. Although there is a variation in the total SAPSE credit value for any particular study year among the individual study packages of students, the total credit value of a study field stabilizes over a period of three consecutive study years. This means that an accumulated total SAPSE credit value of approximately 3,00 indicates three successful study years. University study involving a minimum study period of more than three years (for instance the medical, engineering and educational fields of study) was made comparable with a three-year study period by checking whether the student concerned had achieved a total SAPSE credit value of at least 2,85 in three years (otherwise in four years). (A total SAPSE credit value of 2,85 instead of 3,00 was used to make allowance for the variation among individual study packages.)

Special Bachelor degrees that are career-oriented rather than generally formative (with the exception of medical, engineering and educational degrees) were excluded from the investigation.

3.2.2 Technikons

At the beginning of 1980 there were 12 fully fledged technikons in the RSA, seven of which were mainly for Whites, one for Coloureds, one for Indians and two for Blacks. Included here was the Technikon RSA which is a non-residential institution offering distance education to students of all population groups. No technikons had at that stage been established in the independent states. To obtain a basis for comparison with the other forms of tertiary institution, only full-time students were involved in the investigation and the study fields were limited to those leading to national diplomas. Technikons offer a very wide variety of study fields and courses and, unlike at universities, all the courses are career-oriented. Consequently students enrol primarily for a diploma as such in one of the many study fields rather than for a variety of subjects. Each of the diplomas consists mainly of a prescribed subject package, with the result that optional subjects constitute a relatively small part of the student's subjects. Furthermore, because the various national diplomas offered at technikons cannot be grouped according to major subjects to nearly the same extent as university degrees, diplomas were classified on the basis of the subject composition of the total course.

The following division appeared to be the most meaningful:

(1) National diplomas concerned mainly with the biological sciences (including agriculture, horticulture, food technology, nature conservation and oceanography).

(2) National diplomas relating to medical and health services (including medical laboratory technology and radiography).

(3) National diplomas concerned mainly with the physical sciences (including material testing, timber, nuclear, explosives, textile and pulp and paper technology, chemistry, fire technology and mining).

(4) National diplomas in engineering, engineering technology, architecture and draughtsmanship.

(5) National diplomas in commerce and management (including administration, secretarial practice, journalism, tourism and cost accounting).

(6) National diplomas in art and design.

3.2.3 Teacher training colleges

At the beginning of 1980 there were 41 teacher training colleges in the territories included in the investigation (the RSA and the independent states) that offered teaching courses requiring at least a Standard 10 school-leaving certificate.

The following division in respect of study course(s) was followed for the teacher training colleges:

(1) Diploma courses in primary education (including preprimary, primary, senior primary education diploma courses and B.Prim.Ed.).

(2) Diploma courses in secondary education (including junior and senior secondary education diploma courses).

3.2.4 Training colleges for nurses

According to the information obtained there were 32 nursing colleges in the territories involved in the investigation (the RSA and the independent states) at the beginning of 1980.

Courses requiring at least a Standard 10 school-leaving certificate were the following:

(a) 3-year diploma course for registration in general nursing;

(b) 3½-year diploma course for registration in general nursing and midwifery;

(c) 3½-year diploma course for registration in general and psychiatric nursing;

(d) 3-year diploma course for registration in psychiatric nursing, or a one-year course if it follows a previous diploma in nursing;

(e) 3-year diploma course for registration in midwifery, or a one-year course if it follows a previous diploma in nursing.

There are three intakes of first-year nursing students a year. Only the February-March and June intakes of 1980 were involved in the investigation.

3.3 PARAMETERS ON WHICH INFORMATION WAS OBTAINED

With regard to the school study record, the investigation was based on information that was readily available either from the tertiary institution concerned or from the examining body under which the Standard 10 examination was written. Information was obtained in respect of the following parameters of the school study record:

- Year in which the Standard 10 examination was passed (1976, 1977, 1978 or 1979)
- Nature of the certificate obtained (with/without matriculation exemption)
- Examining body
- Language medium at school (Afrikaans, English or dual medium, i.e. English and Afrikaans)
- Nature of the examination (internal/external)
- Control of the school (A distinction was drawn between provincial or government schools, provincial or state-aided schools and private schools)
- Home language (insofar as it was known)
- Subjects offered in the examination and the level at which each of the subjects was written, and the (adjusted) marks obtained in each of the subjects
- Aggregate obtained in the examination

With regard to the tertiary study record, information on the following parameters was obtained on every student included in the sample:

- Tertiary institution at which enrolled in 1980
- Registration number
- Name (not included in the final data set)
- Sex

- Date of birth

- Home language (insofar as it was known)

- Parameters required in order to obtain the student's school study record, including the name of the secondary school or examination centre, year in which the Standard 10 examination was passed, examining body and examination number.

- Military training undergone or not.

- In respect of the 1980 study record*) (the first examination**) in the case of technikons)

  .. study course for which enrolled

  .. minimum duration of this study (teacher training colleges) or the minimum number of examinations (technikons)

  .. for each of the subjects for which enrolled in respect of

  ... universities: the SAPSE classification, SAPSE credit value and percentage obtained in the examination

  ... technikons: the examination code and the percentage obtained in the examination

  ... nursing colleges: the percentage obtained in the examination

  .. total SAPSE credit value obtained (universities)

  .. mean percentage obtained for all the subjects for which enrolled (teacher training colleges and nursing colleges)

  .. with/without promotion to the second study year (second examination in the case of technikons) (technikons, teacher training colleges and nursing colleges).

- In respect of the 1981 study record*) (the second examination in the case of technikons)

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*) Including the January-March supplementary examinations of the following year.

**) In the case of technikons the examination may concern either a semester or a year, depending on the requirements of the course.

.. study course for which enrolled

.. total SAPSE credit value obtained (universities)

.. complied/did not comply with the diploma requirements (in the case of two-year teaching diplomas).

- In respect of the 1982 study record*) (the third examination in the case of technikons)

  .. study course for which enrolled

  .. total SAPSE credit value obtained (universities)

  .. complied/did not comply with the requirements of the diploma or (three-year) degree, or obtained/did not obtain an accumulated SAPSE credit value of at least 2,850 (in the case of degrees with a minimum study period of more than three years).

- In respect of the 1983 study record**) (the fourth examination in the case of technikons)

  .. study course for which enrolled

  .. total SAPSE credit value obtained (universities)

  .. complied/did not comply with the requirements of the diploma or (three-year) degree, or obtained/did not obtain an accumulated SAPSE credit value of at least 2,850 (in the case of degrees with a minimum study period of more than three years).

- In respect of the fifth and sixth examinations (technikons)

  .. study course for which enrolled

  .. complied/did not comply with the requirements of the diploma.

- In respect of the achievement level at which the degree/diploma was obtained

  .. universities: for each of the major or third-year subjects the SAPSE classification, the SAPSE credit value and the percentage

*) Including the January-March supplementary examinations of the following year.

**) Excluding the January-March 1984 supplementary examinations.

obtained in the examination

.. technikons: the mean percentage of all subjects taken for the diploma

.. teacher training colleges: the mean percentage obtained in the final year subjects

.. nursing colleges: the percentage obtained in the examination in each of the third-year subjects.

. In respect of course changes during the study period (technikons and teacher training colleges)

.. did/did not change courses

.. course change led/did not lead to an extension of the minimum study period

.. total number of semesters/years for which student was registerd.

3.4 THE SAMPLE

The investigation was based on a 50 % sample of the target group by drawing every second student concerned from the records of the tertiary institutions involved in the investigation, excluding nursing colleges.*) Questionnaire A was completed in respect of each of the sampled students in order to identify the student and obtain his/her school study record from the education department/examining body concerned. This information was captured with the help of a computer. This sample will be referred to as the A sample.

Next the information regarding the school study record of the students in the A sample was obtained from the education departments/examining bodies. This subgroup of the A sample in respect of whom the minimum information regarding the school study record could be obtained, will be referred to as the B sample.

Finally the tertiary institutions had to provide the required information regarding the tertiary study of each of the students included in the A sample. The subgroup of the A sample in respect of whom the minimum required information regarding their tertiary study could be obtained, will be referred to as the C sample.

*) In the case of the nursing colleges the records of the register of the first-year examination results of the SANC was used for this purpose.

The A, B and C samples were compared and the subgroup of students included in all three of these samples will be referred to as the ABC sample. The ABC sample therefore constituted the data set used in the statistical analyses and modelling. In the tables concerning the realization of the sample which are given below, the numbers of students in the A sample (or the AC sample in certain cases) and in the ABC sample are provided for the different tertiary institutions.

TABLE 3.1

NUMBER OF UNIVERSITY STUDENTS INVOLVED IN THE INVESTIGATION

UNIVERSITY	NUMBER OF STUDENTS	
	A SAMPLE	ABC SAMPLE
1	824	755
2	853	674
3	940	889
4	954	752
5	602	557
6	461	391
7	210	175
8	272	257
9	170	163
10	410	378
11	610	324
12	386	326
13	323	212
14	297	248
15	219	212
16	278	214
T O T A L	7 440	6 527

TABLE 3.2

NUMBER OF TECHNIKON STUDENTS INVOLVED IN THE INVESTIGATION

TECHNIKON	NUMBER OF STUDENTS	
	AC SAMPLE	ABC SAMPLE
1	326	223
2	305	220
3	555	387
4	359	276
5	269	131
6	174	1
7	151	145
8	39*)	26
9	36*)	29
T O T A L	2 214	1 438

*) With regard to these technikons the whole target group was included in the sample because of the small numbers involved.

TABLE 3.3

THE NUMBER OF TEACHER TRAINING COLLEGE STUDENTS INVOLVED IN THE INVESTIGATION

TEACHER TRAINING COLLEGE	NUMBER OF STUDENTS	
	A SAMPLE	ABC SAMPLE
1	30	30
2	45	39
3	41	39
4	60	57
5	73	68
6	38	36
7	40	38
8	16	14
9	78	70
10	27	25
11	37	36
12	159	142
13	108	104
14	218	211
15	214	200
16	43	37
17	84	80
18	15	12
19	97	90
20	85	81
22	21	20
23	77	74
24	36	33
25	62	58
27	152	144
28	53	41
29	35	30
30	25	17
33	36	29
36	26	19
37	16	7
38	67	56
41	81	63
43	39	11
44	60	41
T O T A L	2 294	2 052

TABEL 3.4

THE NUMBER OF STUDENT NURSES INVOLVED IN THE INVESTIGATION

CONTROLLING BODIES OF TRAINING SCHOOLS	NUMBER OF STUDENTS	
	AC SAMPLE	ABC SAMPLE
1	493	279
2	336	133
3	75	25
4	725	359
5	58	25
6	25	10
7	52	13
8	8	4
9	28	6
10	14	3
11	61	37
12	9	3
13	22	16
T O T A L	1 906	913

CHAPTER 4

STATISTICAL ANALYSIS AND MODEL BUILDING

4.1 INTRODUCTION

Following on Par. 3.1, the primary aim of this chapter is to determine which explanatory variables (predictors) made a statistically significant contribution towards explaining the variation in the relevant dependent variables, namely first-year achievement as well as final achievement. The categories of final achievement were also defined in such a way that the extent to which the student had succeeded in achieving success, is indicated.

As possible explanatory variables the student's achievement in the school final examination was considered first — in the school aggregate as well as in his school subjects, with the latter grouped according to certain subject groupings. The following were also considered as explanatory variables: sex, age, year in which matriculation exemption was obtained, home language, medium of instruction, examining body, tertiary institution and tertiary study field.

After the most important predictors for each of the tertiary study fields had been identified with the help of different statistical techniques (including CHAID analyses, correspondence analyses and discriminant analyses), these predictors were incorporated in a regression model as explanatory or independent variables. It was thus possible to determine the extent to which the variation in the dependent variables (first-year achievement and final achievement) could be explained by means of such a model in which the influence of these explanatory variables was considered collectively. Through this model it was possible to determine the effect inter alia that an increase in the required minimum school aggregate and/or the introduction of minimum achievement in particular school subjects would have had on the expected success rate as well as on the expected failure rate in the different study fields. Finally, the extent to which it was possible to discriminate between success and failure in the different tertiary study fields by using particular discriminant functions, was also determined.

4.2 ACHIEVEMENT PARAMETERS

4.2.1 School achievement parameters

The maximum marks that can be obtained in a subject in the Standard 10 final examination were transformed into the following values for the different examining bodies insofar as this was necessary:

First language HG*)	: 400
First language SG*)	: 300
Second language HG	: 300
Second language SG	: 300
All other subjects HG	: 400
All other subjects SG	: 300

For matriculation exemption both the first and the second language must be passed at the Higher Grade as well as two other subjects at least. With these minimum matriculation exemption requirements the maximum aggregate that can be obtained is given by

$$(3\times400) + (3\times300) = 2\ 100,$$

so that an aggregate of 1 050 means an average pass figure of 50 %. The minimum aggregate that must be obtained for matriculation exemption at present is 950, which means an average pass figure of approximately 45 %.

In the model building the marks obtained in a school subject were used unchanged, irrespective of whether the subject was taken at the Higher Grade or at the Standard Grade. This point of departure has the following implications:

Number of marks obtained	Actual percentage if subject was taken at the SG	Percentage allocated irrespective of the grade at which the subject was taken
240	80 %	60 %
180	60 %	45 %
120	40 %	30 %

Only the adjusted mark was used throughout and no further attention was paid to whether or not a candidate wrote and/or passed a subject at HG or at SG.

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*) HG indicates the Higher Grade and SG the Standard Grade.

Since a large variety of subjects can be taken at school it was necessary, with a view to model building, to decrease the number of school subjects drastically. It was decided to work with the JMB's school subject groupings, except where in Group A a distinction is drawn between first and second language and in Group C between Biology and Physical Science. The school subject groupings of the JMB are as follows:

Group A : Afrikaans and English
Group B : Mathematics
Group C : Biology and Physical Science
Group D : German, French, Latin, various Black languages, etc.
Group E : Geography, Biblical Studies, Economics and History
Group F : Business Economics, Home Economics, Art, Music, Accountancy, Typing, etc.

In the model building process provision was made for more than one subject being taken from the same subject grouping.

4.2.2 University achievement parameters

1. First-year achievement

In Par. 3.2.1 it was stated that the SAPSE system was used for universities in order to obtain a basis for comparing degrees with a minimum study period of more than three years and three-year degrees. The rationale of the SAPSE system is that the total of the SAPSE credit values of courses in a prescribed study year is approximately one. In calculating the total of the SAPSE credit values of courses for which the beginner students enrolled in the first study year (namely 1980), irrespective of whether these were semester or year courses, it was clear that a marked variation existed in these totals between beginner first-year students in the different study fields at the same university and between students in the same study field at different universities. Since it could reasonably be assumed that more than half of the beginner first-year students enrolling for any particular study field at a university, enrolled for the full quota of prescribed courses (note that only full-time students were involved in the investigation), it was decided to calculate per study field and per university for all the students concerned, the median value of the totals of the SAPSE credit values of the courses for which the students had

enrolled in 1980. These median values, which hereafter will be referred to as the median SAPSE total, varied considerably between different study fields at the same university and between different universities in respect of the same study field.*) The first-year mean percentage was consequently calculated as the weighted sum of the percentages obtained in the first-year courses (each course weighted with its SAPSE credit value) divided by the particular median SAPSE total. In cases where a prescribed study year included one or more attendance courses, these courses were excluded from the calculation of the first-year mean percentage. (This means that also the median SAPSE total for this study year was reduced by the total SAPSE credit value(s) associated with the attendance course(s).)

In the model building process "passed in the first study year" was defined as the student having obtained a first-year mean percentage of 50 at least. Passed in the first study year as defined above is therefore not the equivalent of passed in the first study year or promotion to the second year as defined by the different universities.

2. Final achievement

Successful tertiary study is defined as the student having obtained a degree or diploma. According to Par. 3.2.1 this criterion was used in the case of three-year degrees, while an accumulated total SAPSE credit value of 2,85 was used for degrees where the minimum study period exceeds three years. A distinction was drawn between students who complied with the criterion in three years and in four years respectively. Apart from the above criterion for successful tertiary study, first-year achievement was also used as a variable in the investigation.

In the light of the above it was decided to introduce final achievement as a categorical dependent variable in the investigation in terms of the following categories:

*) In a typical case the median SAPSE total for the same study field varied from 0,700 to 1,050 among universities.

Category values of final achievement	Definition of the categories
1	Had still not passed the prescribed first study year after two academic years (accumulated SAPSE credit value of courses passed in first two study years < median SAPSE total as defined in Par. 4.2.2(1))
2	Passed the prescribed first study year in two years, but still had not complied with the criterion requirement after four years
3	Complied with the criterion requirement in four years
4	Complied with the criterion requirement in three years with a final year percentage of less than 65
5	Complied with the criterion requirement in three years with a final year percentage of between 65 and 74
6	Complied with the criterion requirement in three years with a final year percentage of 75 or higher

In the above table "complied with the criterion requirement" means that the criterion for successful tertiary study as defined above was complied with, and "final year percentage" refers to the average weighted percentage obtained in the third-year or final year subjects, using the SAPSE credit values of the third-year or final year courses again as weights (the percentage was calculated in the same way as in the case of the first-year mean percentage).

If the category value of the variable final achievement was smaller than or equal to 2, the student did not comply with the criterion for successful tertiary study and was classified as a failure. A student was classified as having passed when his category value for final achievement was equal to 3 at least.

The categories of the variable final achievement were chosen with a view to obtaining a relatively high association with first-year achievement. This was made possible through the use of correspondence analysis.

4.2.3 Technikon achievement parameters

The first examination achievement was calculated here as the mean percentage obtained in all the subjects written by a student during the first examination. Successful tertiary study in the case of the technikons was defined as the student having passed the theoretical part of the diploma. The categorical variable final achievement, which was used as dependent variable in the investigation, was defined as follows:

Category values of final achievement	Definition of categories
1	Did not complete the theoretical part of the diploma
2	Completed the theoretical part of the diploma with a final percentage of below 60
3	Completed the theoretical part of the diploma with a final percentage of 60 or higher

In the above table "final percentage" refers to the mean percentage obtained in all the examinations in all the subjects taken for the diploma.

4.2.4 Achievement parameters for teacher training colleges

In the case of students at teacher training colleges first-year achievement was defined as the mean percentage obtained in the examination in the first study year (i.e. 1980), in respect of all the subjects for which a student enrolled.

Successful tertiary study in the case of teacher training colleges was defined as the student having obtained the particular teaching diploma. Final achievement, which was used as a dependent variable in the investigation, was defined as follows as a categorical variable:

Category values of final achievement	Definition of the categories
1	Failed in the first study year (average percentage of below 50)
2	Passed in the first study year but did not comply with the criterion for successful tertiary study
3	Complied with the criterion for successful tertiary study with a final year percentage of 59 at the most
4	Complied with the criterion for successful study with a final year percentage of 60 to 64
5	Complied with the criterion for successful study with a final year percentage of 65 or higher

In the above table "final year percentage" refers to the mean percentage obtained in the final year subjects.

4.2.5 Nursing college achievement parameters

The first-year achievement was defined as the mean percentage obtained in the examination in the first year, for all the prescribed subjects irrespective of whether the student obtained admission to the second study year or not.

As in the case of the other tertiary institutions, successful study was defined as the student having obtained a diploma. Final achievement was defined as follows as a categorical dependent variable:

Category values of final achievement	Definition of categories
1	Did not comply with the diploma requirements in the minimum or extended study period
2	Complied with the diploma requirements in the minimum or extended study period

4.3 STATISTICAL ANALYSIS AND MODEL BUILDING IN THE CASE OF UNIVERSITY STUDY

4.3.1 Introduction

Previous studies as summarized in Chapter 2 identified the aggregate obtained in the matriculation examination as apparently the "best" predictor of successful tertiary study. Even so practice has shown that the current required minimum aggregate mark of 950 for matriculation exemption, generally speaking, does not discriminate adequately between successful and unsuccessful university students. The investigation of Crouse et al. indicated that a considerably higher aggregate was required for success in B.Sc. and B.Comm. studies than in B.A. studies. The above investigation also indicated that achievement in the mother tongue and/or in Mathematics was related to successful tertiary study, but to a lesser extent than the aggregate mark. In this respect the situation differed with regard to the B.A. degree on the one hand and the B.Comm. and B.Sc. degrees on the other.

4.3.2 CHAID analyses for identifying the predictors of final achievement

In view of the results mentioned in Par. 4.3.1, it was decided to distinguish first of all between the following fields of study in model building:

- B.Sc.(Mathematics) field: Enrolled at least for
  - .. courses in the mathematical sciences with a total SAPSE credit value of at least 0,400 (SAPSE classification numbers 16.01-16.99); or
  - .. courses in the mathematical sciences with a total SAPSE credit value of at least 0,200 supplemented by courses from the physical sciences with a SAPSE credit value of at least 0,200 (SAPSE classification numbers 15.04, 15.07-15.99); or
  - .. courses in the specified physical sciences with a total credit value of at least 0,400.
- B.Sc.(Non-Mathematics) field: All other B.Sc. study fields.
- B.A.(Languages) field: Enrolled in the first study year for at least two language subjects with a total SAPSE credit value of at least 0,400.
- B.A.(Non-Languages) field: All other B.A. study fields.
- B.Comm. field. (The B.Comm. study field could not be meaningfully subdivided into, for instance, an Accountancy and Non-Accountancy field.)
- B.Sc.Eng. field.
- B.Med. field: This field includes the medical and dental study fields.

N.B.: The B.A.(Ed.), B.Sc.(Ed.) and B.Comm.(Ed.) students were classified respectively as B.A., B.Sc. and B.Comm. students.

With final achievement as the dependent variable, a CHAID analysis* was performed first with the following explanatory variables or predictors: university study field, school aggregate, sex, age, university, examining body, home language, year in which matriculation exemption was obtained, medium of school instruction and population group. For this analysis the school aggregate was transformed into a categorical variable, as will be indicated later. For the first step of the CHAID analysis the following probabilities of exceedance correspond with each of the above predictors (only the first step of the analysis is reproduced here):

*See Appendix A, Par. A.2.1(1).

Predictor	Probability of exceedance (%)
Study field	1,030E-66
School aggregate	7,895E-220
Sex	2,057E-21
Age	2,336E-05
University	3,337E-137
Examining body	4,636E-121
Home language	2,649E-19
Year of matriculation	0,325
Medium of school instruction	2,882E-08
Internal/External examination	8,930E-37
Population group	5,959-110

The categories into which school aggregate (SGT) was divided for the CHAID analysis are the following:

Category	Category value
950 ≤ SGT < 1 050	1
1 050 ≤ SGT < 1 250	2
1 250 ≤ SGT < 1 450	3
1 450 ≤ SGT < 1 650	4
1 650 ≤ SGT < 1 850	5
1 850 ≤ SGT	6

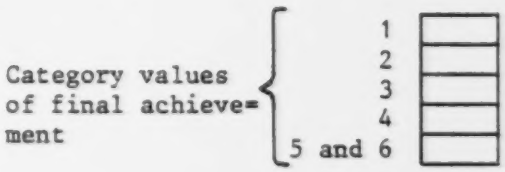
From the above CHAID analysis it appears that school aggregate was associated the highest with final achievement, which made it the best predictor of final achievement. The second step of the CHAID analysis, where each of the categories of the school aggregate was considered separately, indicated that in half of these categories the variable university had the highest association with final achievement, while in the other categories field of study emerged as the strongest predictor of final achievement. It also appears that in most of the cases where university was the best predictor in the second step of the CHAID analysis, study field emerged as the best predictor in the third step, and where study field was the best predictor in the second step of the CHAID analysis, each of examining body and university appeared to be the best predictor in the third step in approximately half of the cases. From this it appears that there was a relation between school aggregate, university and study field in the prediction of final achievement. It was therefore necessary to consider the different fields of study separately in the statistical analyses and model building.

CHAID analyses were subsequently performed separately for the different study fields as indicated below in order to determine the best predictors of final achievement. The same predictors or explanatory variables as above, with the exclusion of study field, were used in these analyses.

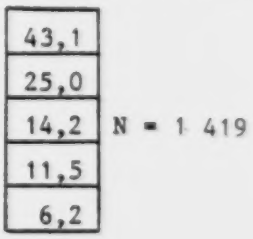
Figures 4.1 to 4.5 indicate the CHAID analyses for the B.A., B.Sc., B.Comm., B.Med. and B.Sc.Eng. fields respectively. With the exception of the B.Med. field, school aggregate appeared to be the best predictor of final achievement, with university emerging as the best predictor in respect of the medical field.

In the second step of the CHAID analyses the same pattern of predictor(s) did not emerge for the different study fields, although university appeared to be one of the second-level predictors for all the study fields except the medical field. Other second-level predictors were examining body, home language, internal/external examination and year of matriculation. It is clear therefore that there was a different pattern of predictors for the different study fields. Sex did not feature as a predictor at all. A further point of interest is that for the category value 2 of school aggregate, i.e. the category $1\,050 \leq SGT < 1\,250$, the variable university appeared to be the strongest predictor for the B.Sc., B.A. and B.Comm. study fields.

The CHAID diagrams or dendrograms consist of blocks with five subdivisions each, as follows:



The subdivisions of each block correspond to the five categories of the dependent variable final achievement, where the fifth and sixth categories are grouped together (see Par. 4.2.2(2)). The block for the B.Sc. field of study,



for instance, therefore indicates that

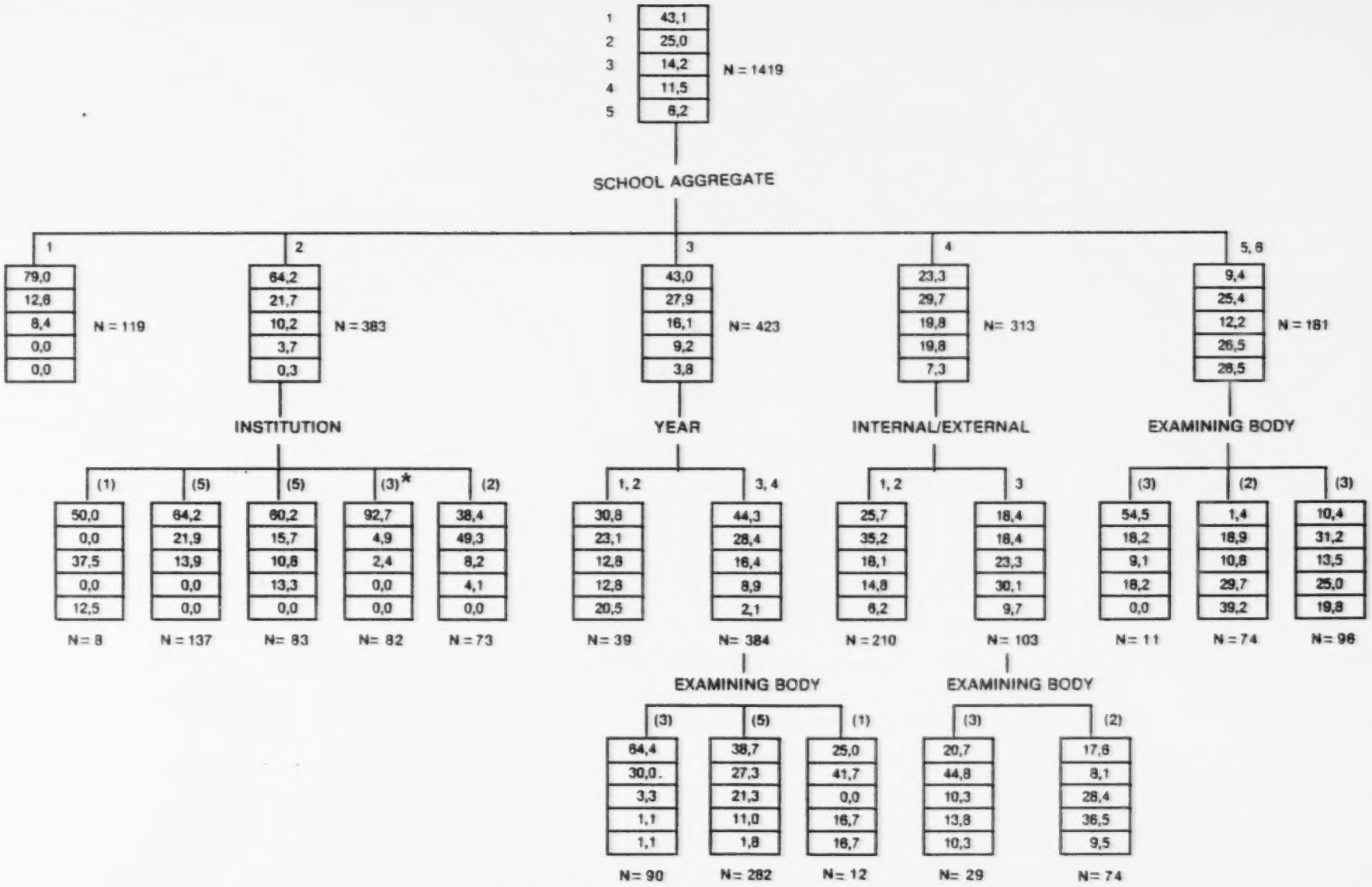


FIGURE 4.1: CHAID ANALYSIS OF FINAL ACHIEVEMENT FOR THE B.Sc. STUDY FIELD

*)"(3) means, for example, that three institutions are grouped together in this branch. The same applies to examining body.

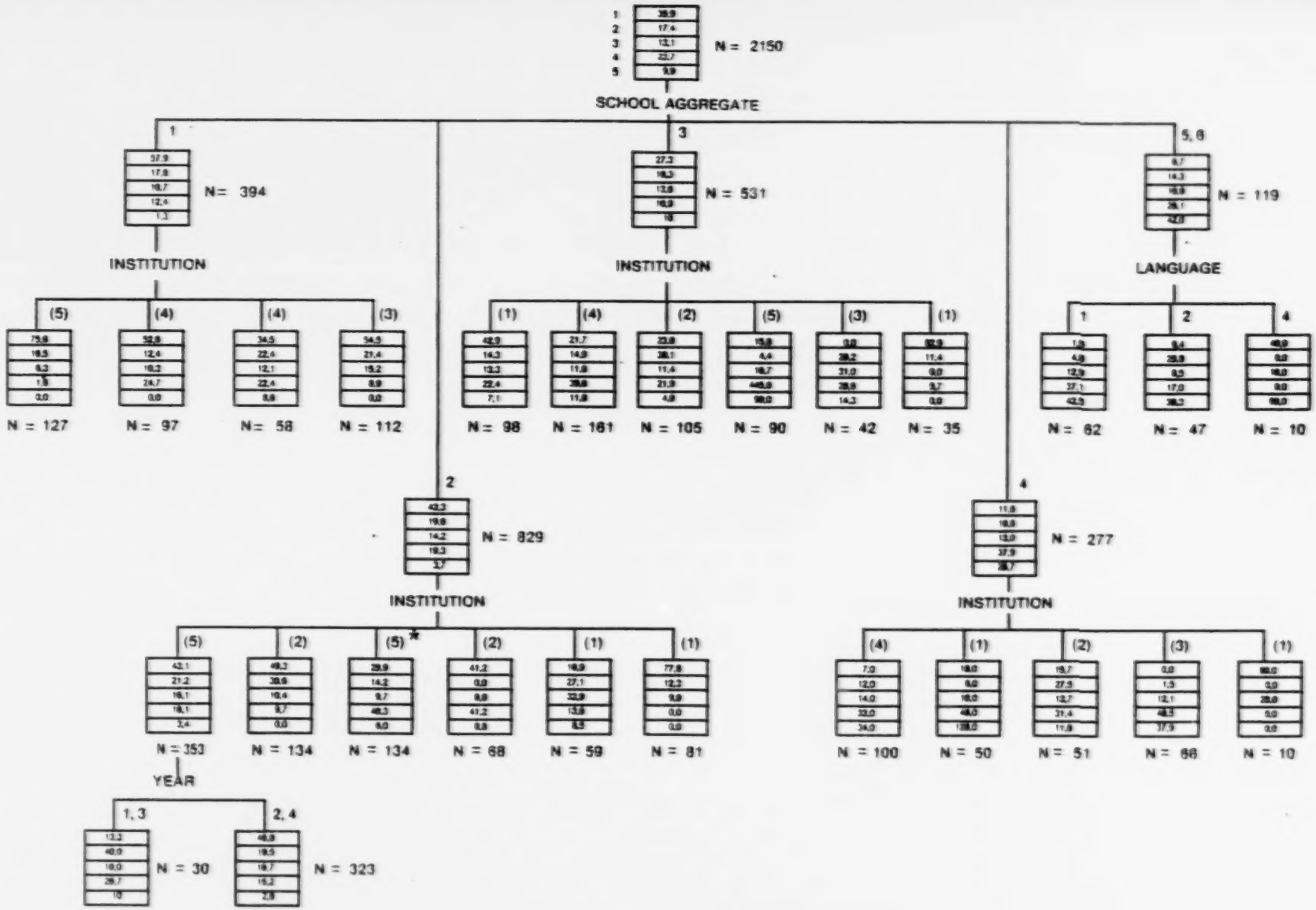


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FIGURE 4.2: CHAID ANALYSIS OF FINAL ACHIEVEMENT FOR THE B.A. STUDY FIELD

*) "(5)" means, for example, that five institutions are grouped together in this branch. The same applies to examining bodies.

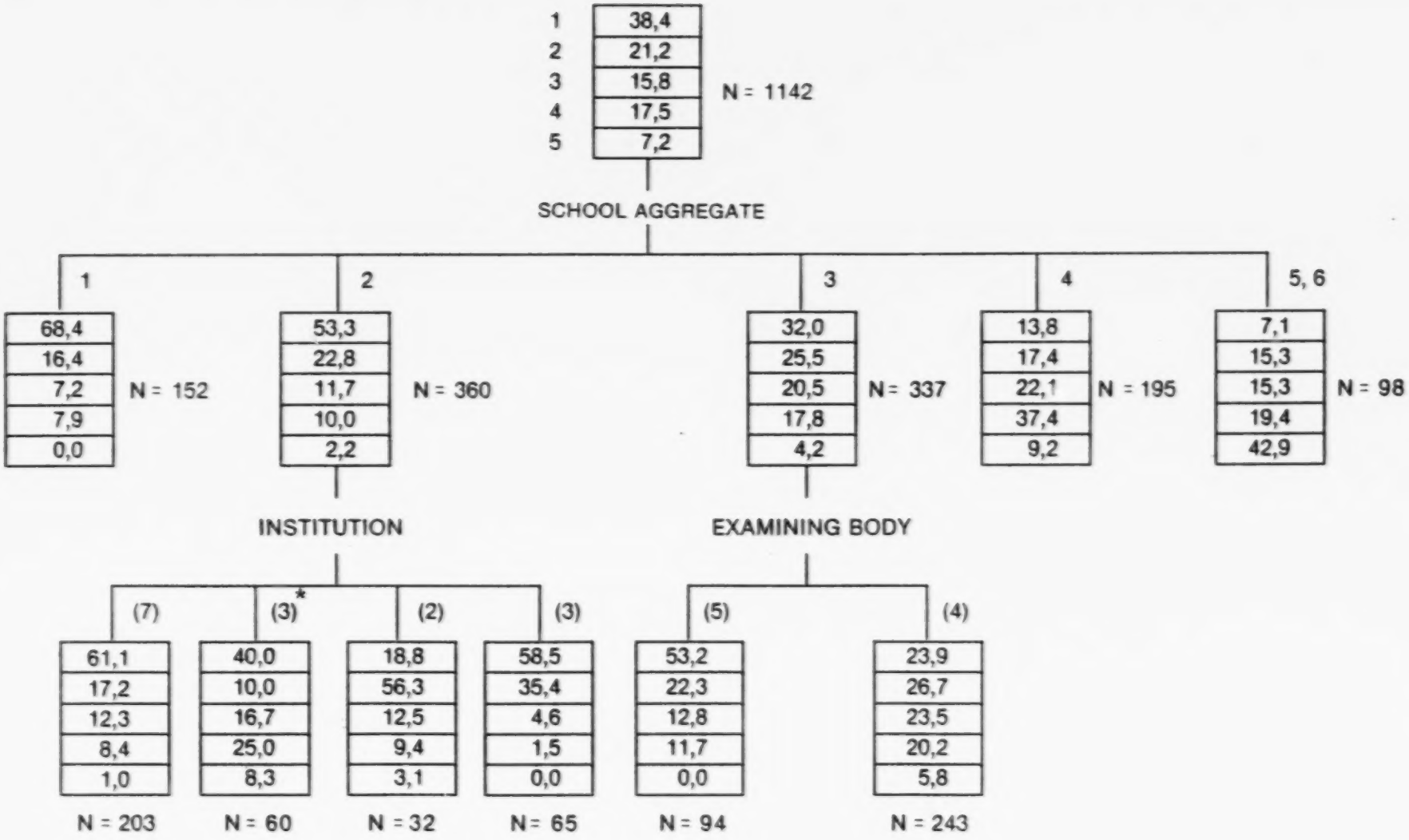

FIGURE 4.3: CHAID ANALYSIS OF FINAL ACHIEVEMENT FOR THE B.COMM. STUDY FIELD

*) "(3)" means, for example, that three institutions are grouped together in this branch. The same applies to examining body.

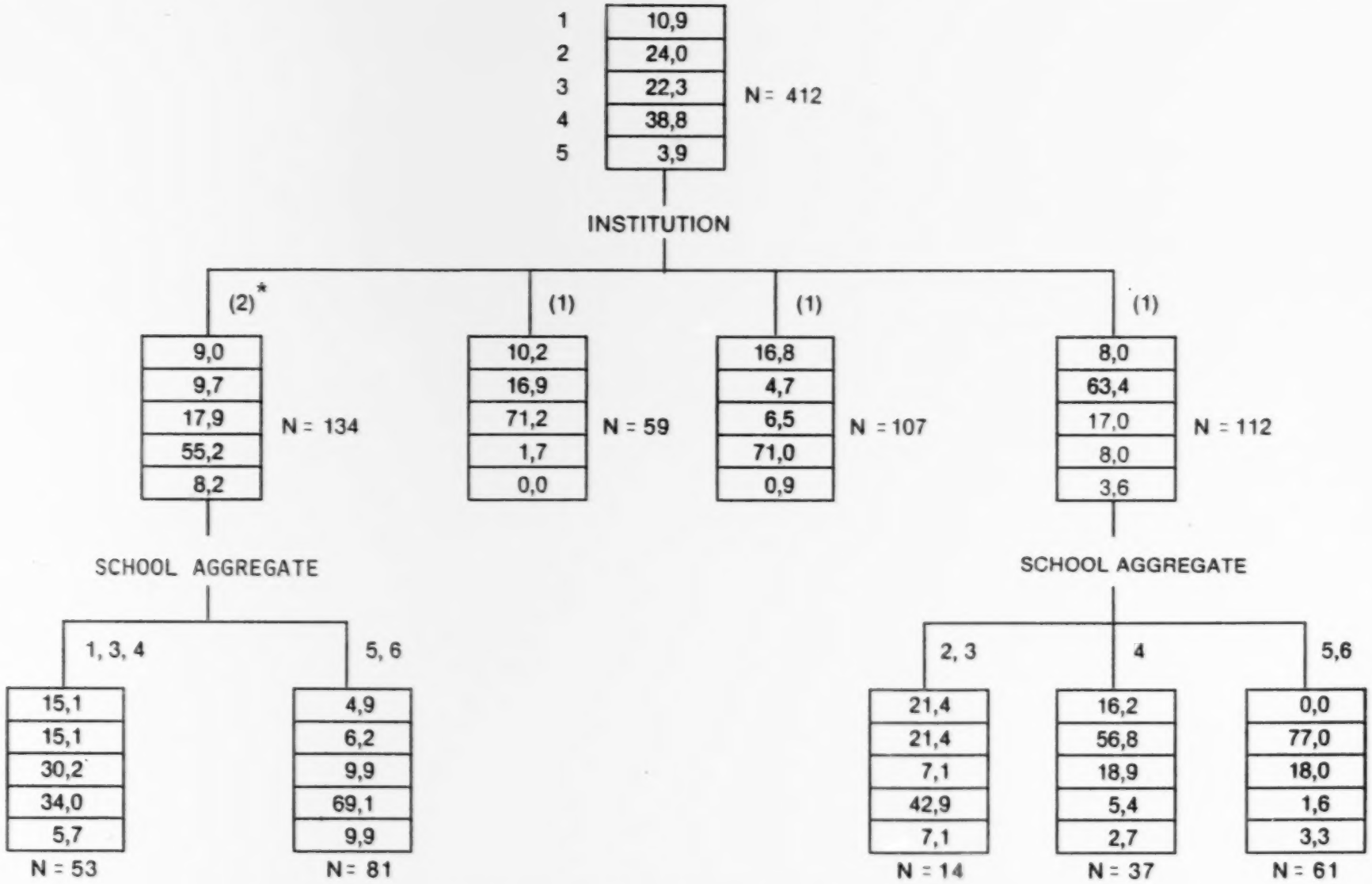

FIGURE 4.4: CHAID ANALYSIS OF FINAL ACHIEVEMENT FOR THE MEDICAL STUDY FIELD

*) "(2)" means, for example, that two institutions are grouped together in this branch.

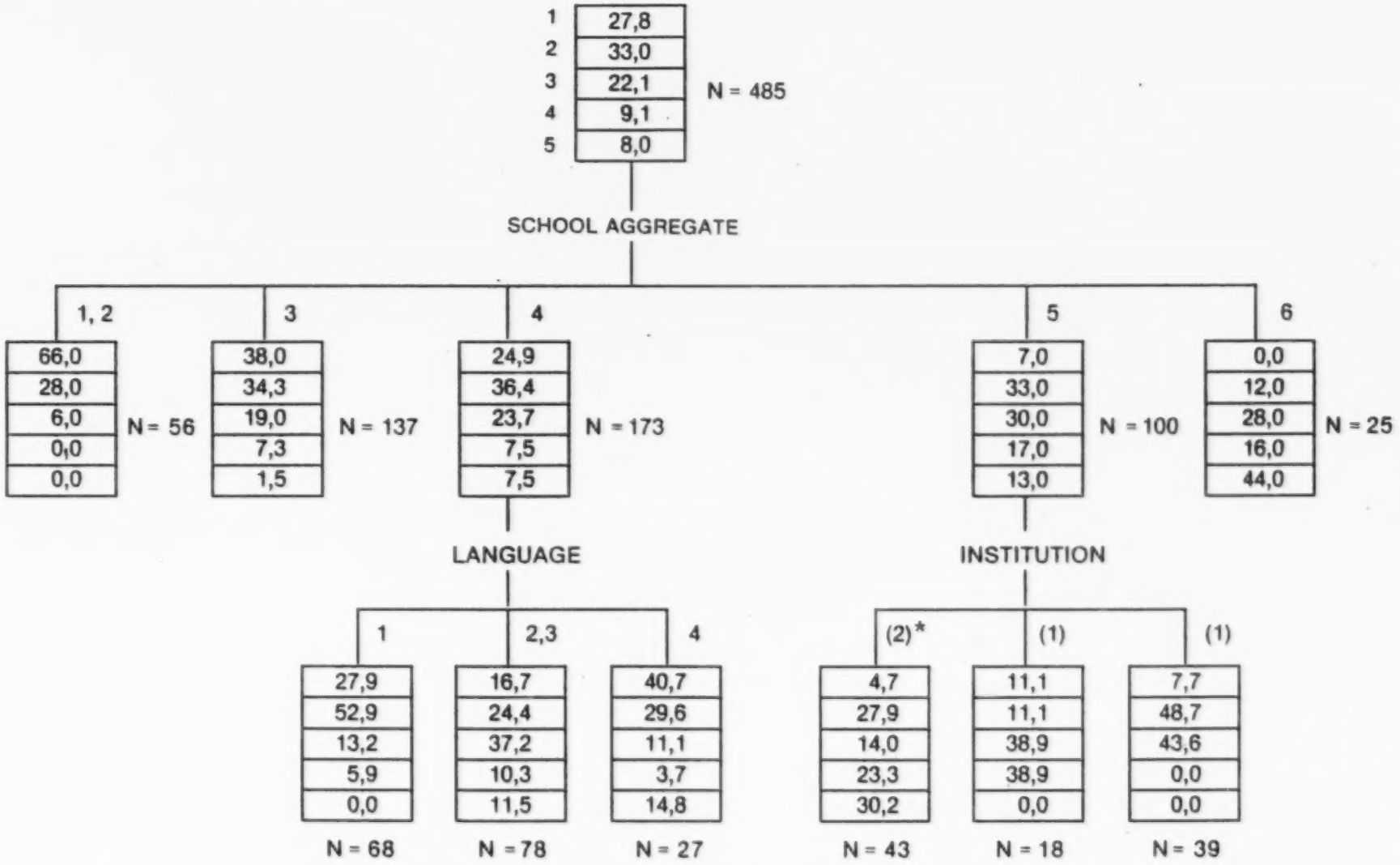

FIGURE 4.5: CHAID ANALYSIS OF FINAL ACHIEVEMENT FOR THE B.Sc. ENG. STUDY FIELD

*)"(2)" means, for example, that two institutions are grouped together in this branch.

- 43,1 % of the students were unable to pass the prescribed first study year in two academic years;
- 25,0 % of the students were able to pass the prescribed first study year in two academic years, but did not obtain the three-year B.Sc. degree in four years;
- 14,2 % of the students obtained the three-year B.Sc. degree in four years;
- 11,5 % of the students obtained the B.Sc. degree in three years with a final year percentage of less that 65, and
- 6,2 % of the students obtained the B.Sc. degree in three years with a final year percentage of 65 or higher.

The "N = 1 419" next to the block indicates that 1 419 students were involved in the analysis.

The other blocks in the CHAID dendrogram should be interpreted in the same way. From the upper block the dendrogram branches out according to the categories or category groupings of the predictor the name of which is inserted just before every branch point of the dendrogram. The figure(s) above each of the blocks (with the exception of the upper block) indicate(s) the categories or category groupings of the predictor with which the particular block is concerned while the N value opposite or below each of the blocks indicates the number of students involved. The CHAID dendrograms in Figures 4.1 to 4.5 can be interpreted in this way.

The question is now, achievements in which of the school subject groups are strong predictors of final achievement both with and without school aggregate as a predictor in the analysis. If achievements in one or more of the school subject groups are associated highly with final achievement, it may be possible to predict successful university study better by introducing minimum requirements in respect of the achievements in these school subject groups in addition to the required minimum school aggregate. It is clear that such minimum achievements in school subject groups may differ for the various university study fields, both in respect of specific subject groups that must be taken and in respect of the minimum achievement required in the school subject groups concerned. CHAID analyses were performed with achievements in school subject groups as explanatory variables in the place of school aggregate, but are not reported here because of the large number of predictors involved and the complexity of the CHAID dendrograms that were obtained. See Par. 4.3.5.

4.3.3 Scaling of achievements in school subject groups

Scaled real values were obtained for the achievement categories of the different school subject groups through correspondence analyses. These real values were subsequently used as the values of the school subject group variables in further statistical analyses, including discriminant and regression analyses.

4.3.4 Determining the relative positions of study fields

Through the use of correspondence analysis the relative positions of the different study fields, together with the achievement categories in each of the fields, were subsequently determined. The following notation was used to compile the contingency table for the correspondence analysis:

Symbol	Category value of final achievement
DR	1
D4	2
S4	3
S3	4
SG	5, 6

Achievement in school subject group

TAE : First language from subject group A
TAT : Second language from subject group A
VB : Subject group B subject (Mathematics)
VC : Subject group C subject (Biology, Physical Science)
VD : Subject group D subject (Third language)
VE : Subject group E subject
VF : Subject group F subject

An "H" after the symbol for the school subject group indicates that at least 70 % was obtained in the subject and a G that less than 70 % was obtained. The symbol VEH, for instance, indicates that at least 70 % was obtained for a subject from school subject group E, and the symbol TATG that less than 70 % was obtained in the second language. The symbol VFN, for instance, is used to indicate that no subject was taken from school subject group F.

Study fields

T1 : B.Sc. + B.Sc.(Ed.)	T2 : B.A. + B.A.(Ed.)	T3 : B.Comm. + B.Comm.(Ed.)
T4 : B.Admin.	T5 : B.Paed.	T6 : B.Med.
T7 : B.Sc.Eng.	T8 : B.Prim.Ed.	T9 : T.D. (Teaching diploma)

As row variable for the contingency table, university final achievement with the following categories was used:

T1DR, T1D4, T1S4, T1S3, T1SG, T2DR, T2D4, T2S4, T2S3, T2SG, . . . , T9DR, T9D4, T9S4, T9S3, T9SG.

As column variable for the contingency table, achievement in school subject group with the following categories was used:

TAEH, TAEG, TATH, TATG, VBH, VBG, VBN, . . . VFH, VFG, VFN.

Correspondence analysis was subsequently performed on contingency tables of the above nature, using different combinations of study fields. Figure 4.6 indicates the graphic representation obtained from the correspondence analysis when all study fields are considered, while in Figure 4.7 only the B.Sc., B.Med. and B.Sc.Eng. study fields are considered.

Interpretation: Figure 4.6 indicates the relative positions of the achievements in the different study fields and their relation to the achievements in the different school subject groups. Consequently, good achievements in school subject groups B and C (VBH and VCH), for instance, correspond with good achievements in the medical and engineering study fields (T6SG and T7SG). A little lower down the graphic representation one finds a good achievement in the B.Sc. field (T1SG), then a good achievement in school subject group D (VDH), and still lower down a good achievement in the B.Comm. field (T3SG), etc. The rest of the figure can be interpreted in this way. A further deduction that can be made is that average achievements in first language (TAEG), second language (TATG) and Mathematics (VBG) seem to correspond with good achievements in the B.Admin. and teaching diploma fields (T4SG and T9SG).

Figure 4.7 can be interpreted in a similar way. It is interesting to note that an average achievement in school subject groups B and C (VBG and VCG) corresponds with an inability to pass the first B.Sc. study year in two academic years.

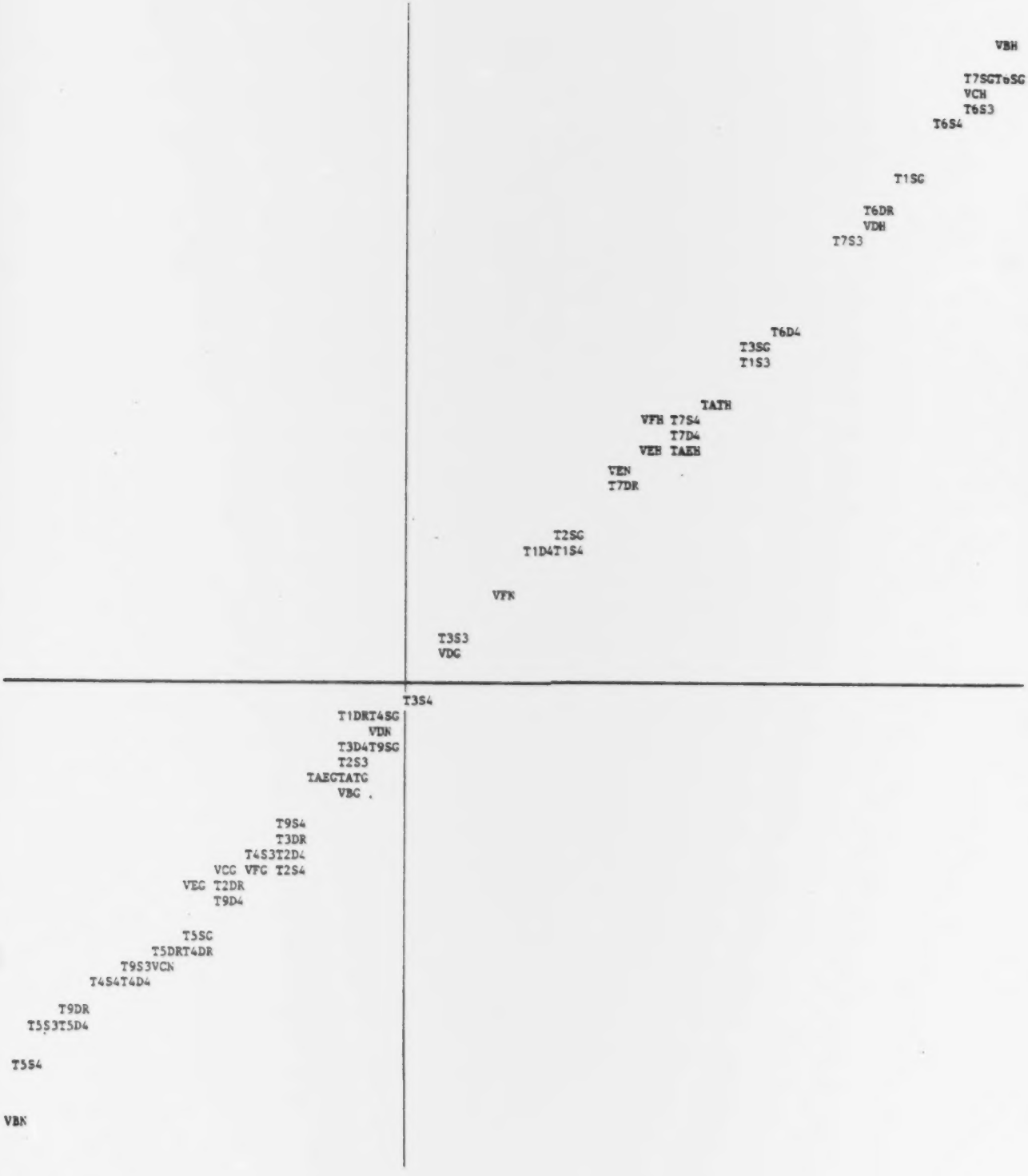

FIGURE 4.6: CORRESPONDENCE ANALYSIS FOR STUDY FIELDS
B.Sc. (T1), B.A. (T2), B.Comm. (T3), B.Admin. (T4)
B.P. (T5), B.Med. (T6), B.Sc.Eng. (T7), T.D. (T9)

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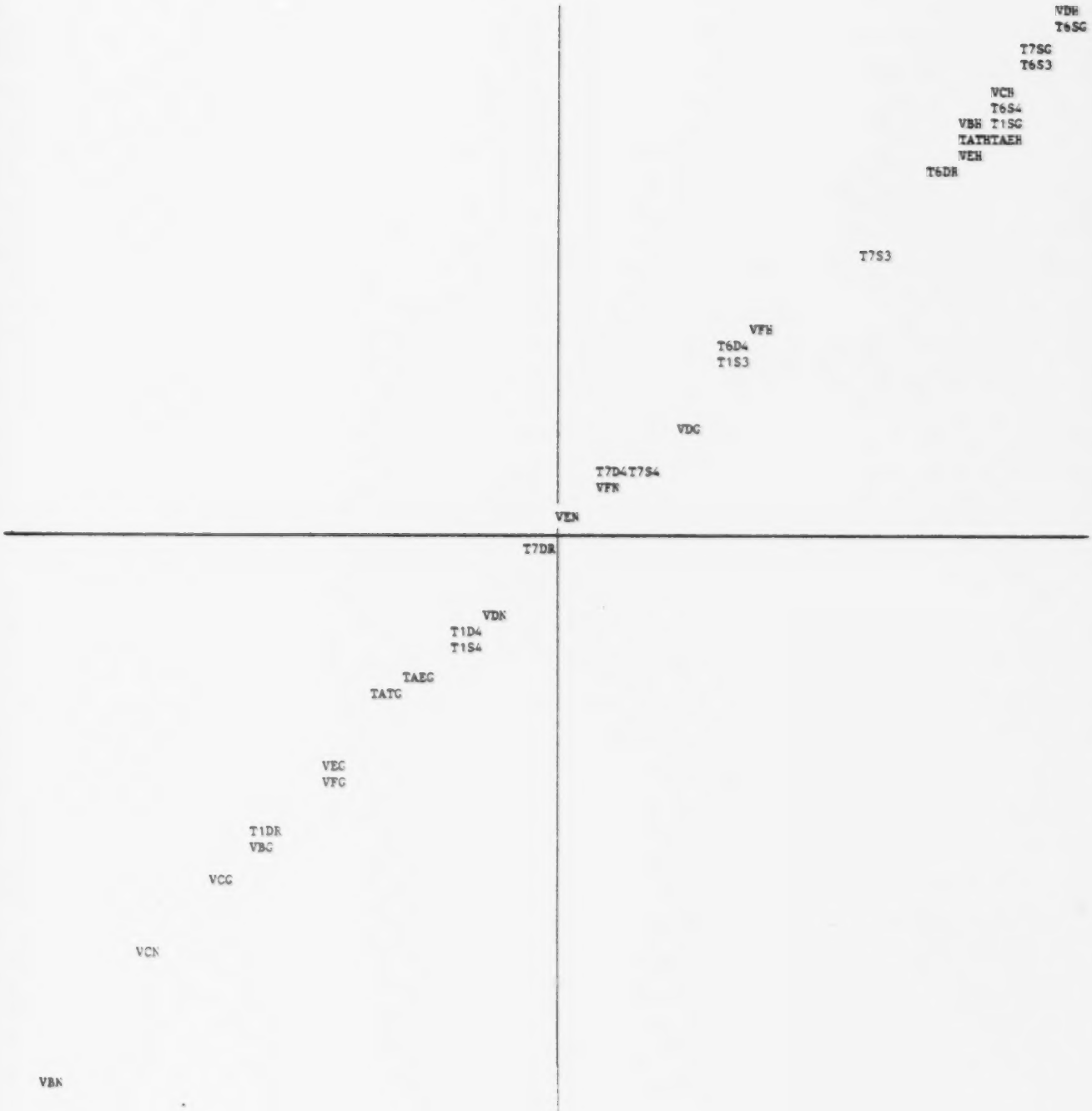

FIGURE 4.7: CORRESPONDENCE ANALYSIS FOR STUDY FIELDS B.Sc.(T1), B.MED. (T6) AND B.Sc.ENG. (T7)

4.3.5 Identification of school subject group packages through correspondence analysis

In a way similar to that described in Par. 4.3.4 an attempt was made through correspondence analysis to determine which of the school subject groups were associated the highest with successful university study. This was done separately for each of the study fields with a distinction drawn now between the B.Sc.(Mathematics) and B.Sc.(Non-Mathematics) study fields and between the B.A.(Languages) and B.A.(Non-Languages) study fields (see Par. 4.3.2 for a definition of these study fields). The same notation as in Par. 4.3.4 was used for achievement in school subject group as well as for university achievement, except that a distinction was now drawn between Biology and Physical Science in school subject group C. The following notation was used for this purpose:

VCB : Biology
VCW : Physical Science

An "H" after the subject symbols indicates as before that at least 70 % was obtained in the subject, and a "G" that less than 70 % was obtained.

Figures 4.8 to 4.14 indicate the graphic representations obtained from the correspondence analyses for the different study fields.

Interpretation: The interpretation of Figures 4.8 to 4.14 is similar to that of Figures 4.6 and 4.7. The figures indicate the extent to which the different categories of the variable final achievement correspond with a high and with an average pass mark in the different school subjects or school subject groups. (Note that a mark of 70 % or more in a school subject was taken as a high achievement (the symbol H) and less than 70 % as an average achievement (the symbol G).) Only tendencies can be deduced from the figures. For a more complete interpretation the correspondence analysis must be performed with more achievement categories for the school subjects or school subject groups. This was in fact done in order to obtain the scaled values of the achievement categories of the school subject groups (see Par. 4.3.3), but these values have not been included in this report.

School subjects or school subject groups in respect of which high achievements correspond with a good achievement in a particular study field (T.SG), and at the same time average achievements in these school subjects or

FIGURE 4.8: CORRESPONDENCE ANALYSIS FOR THE B.Sc.(MATHEMATICS) FIELD OF STUDY (T1)

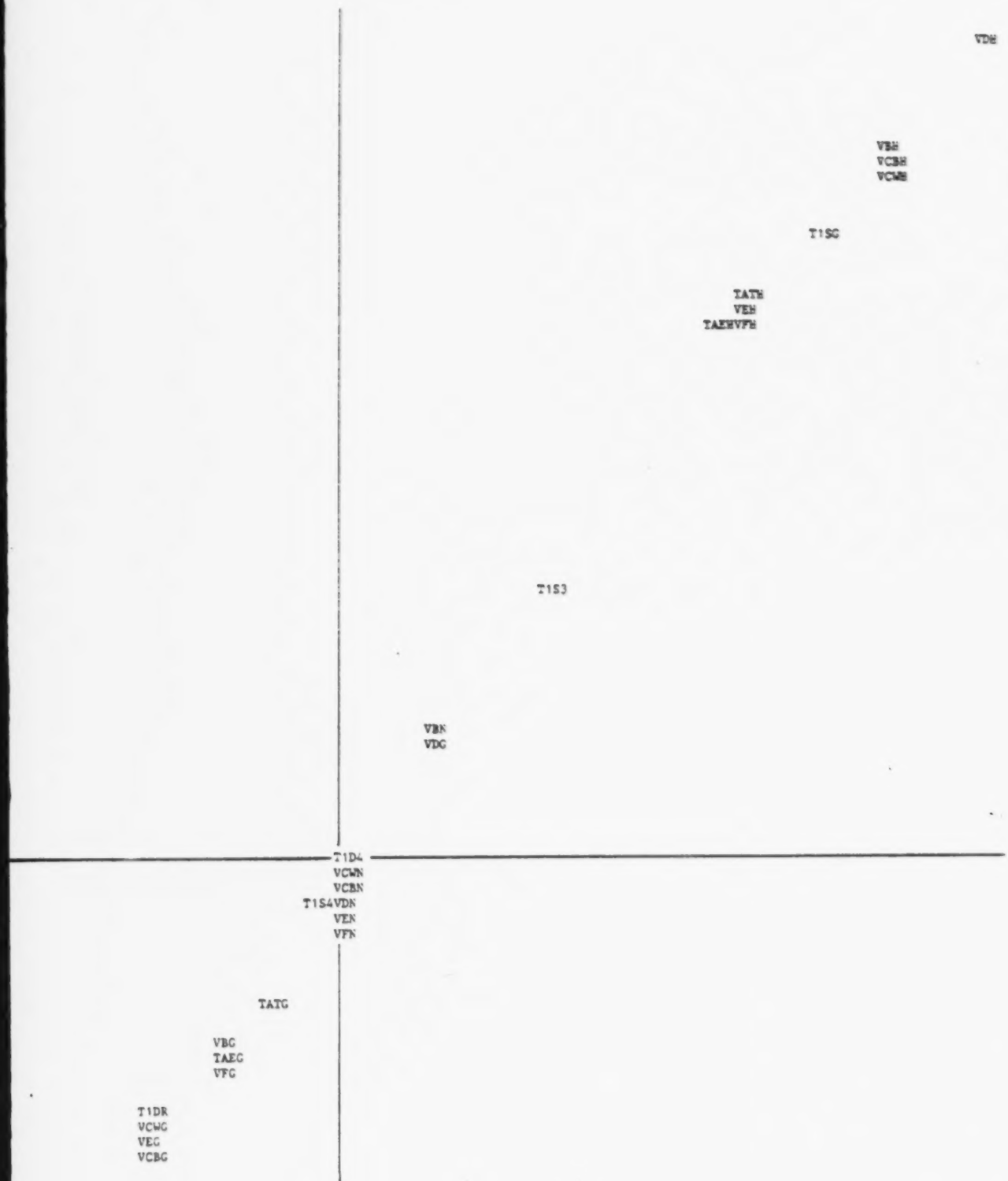

FIGURE 4.9: CORRESPONDENCE ANALYSIS FOR THE B.Sc.(NON-MATHEMATICS) FIELD OF STUDY (T1)

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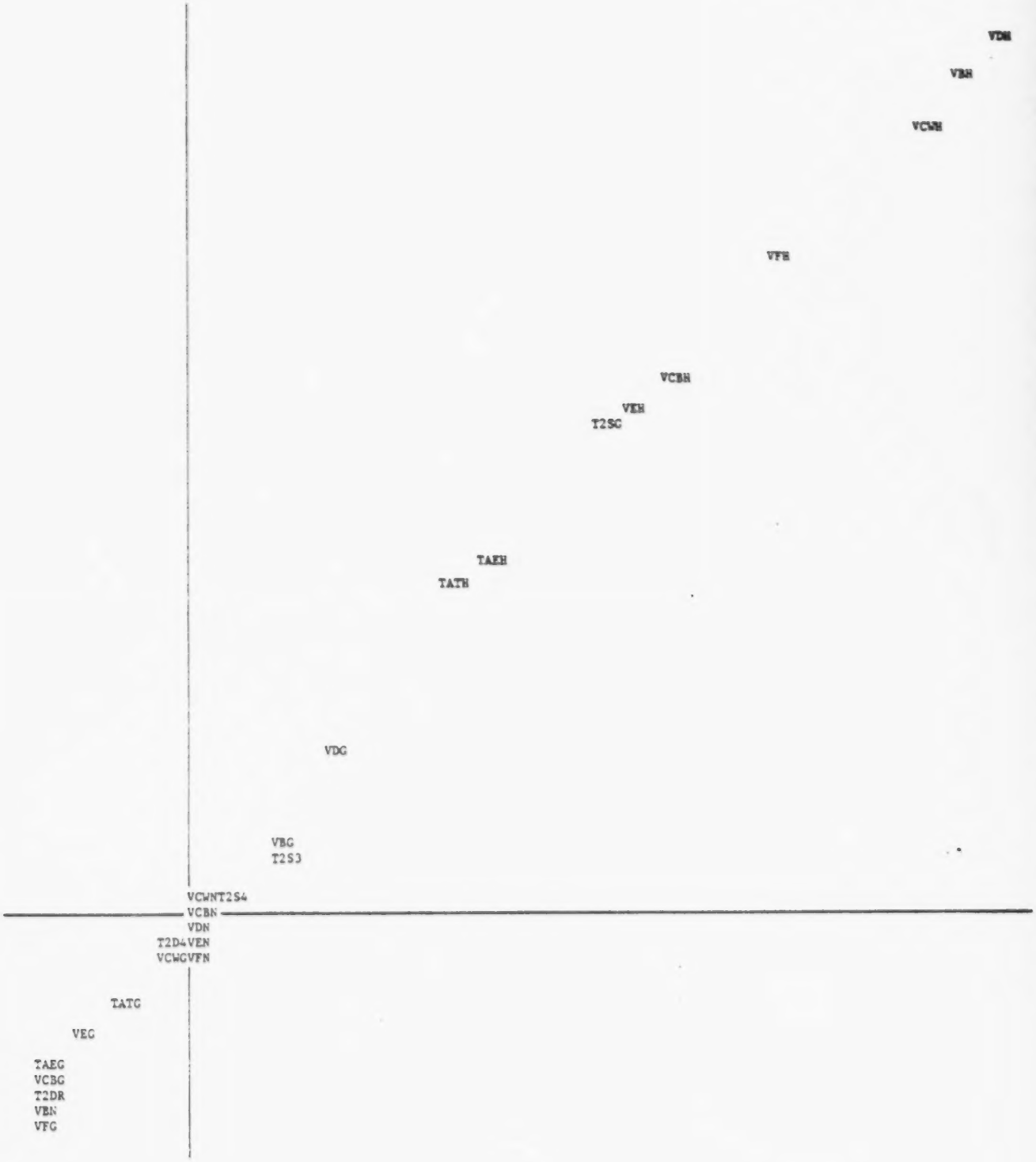

FIGURE 4.10: CORRESPONDENCE ANALYSIS FOR THE B.A. (LANGUAGES) FIELD OF STUDY (T2)

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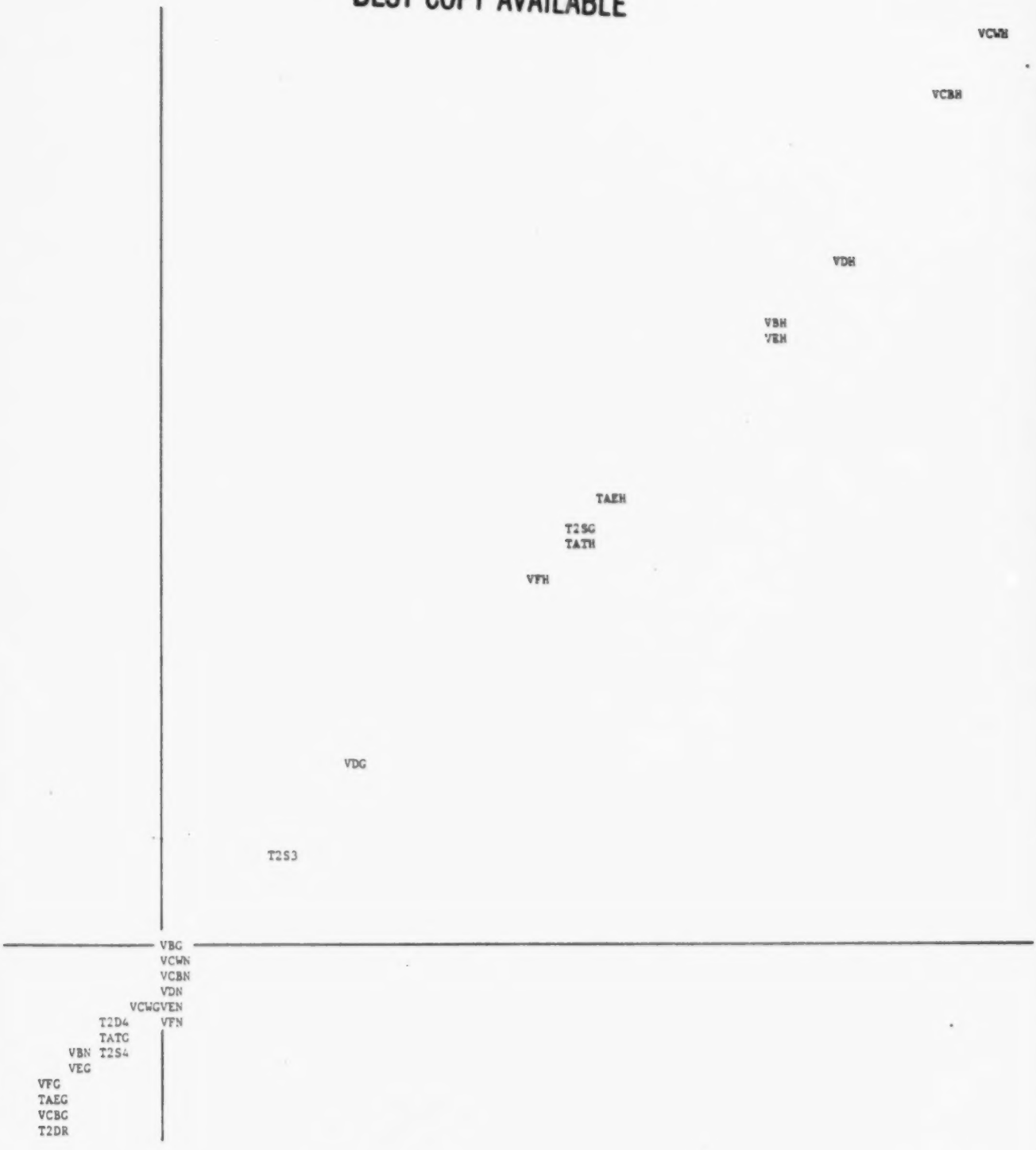

FIGURE 4.11: CORRESPONDENCE ANALYSIS FOR THE B.A. (NON-LANGUAGES) FIELD OF STUDY (T2)

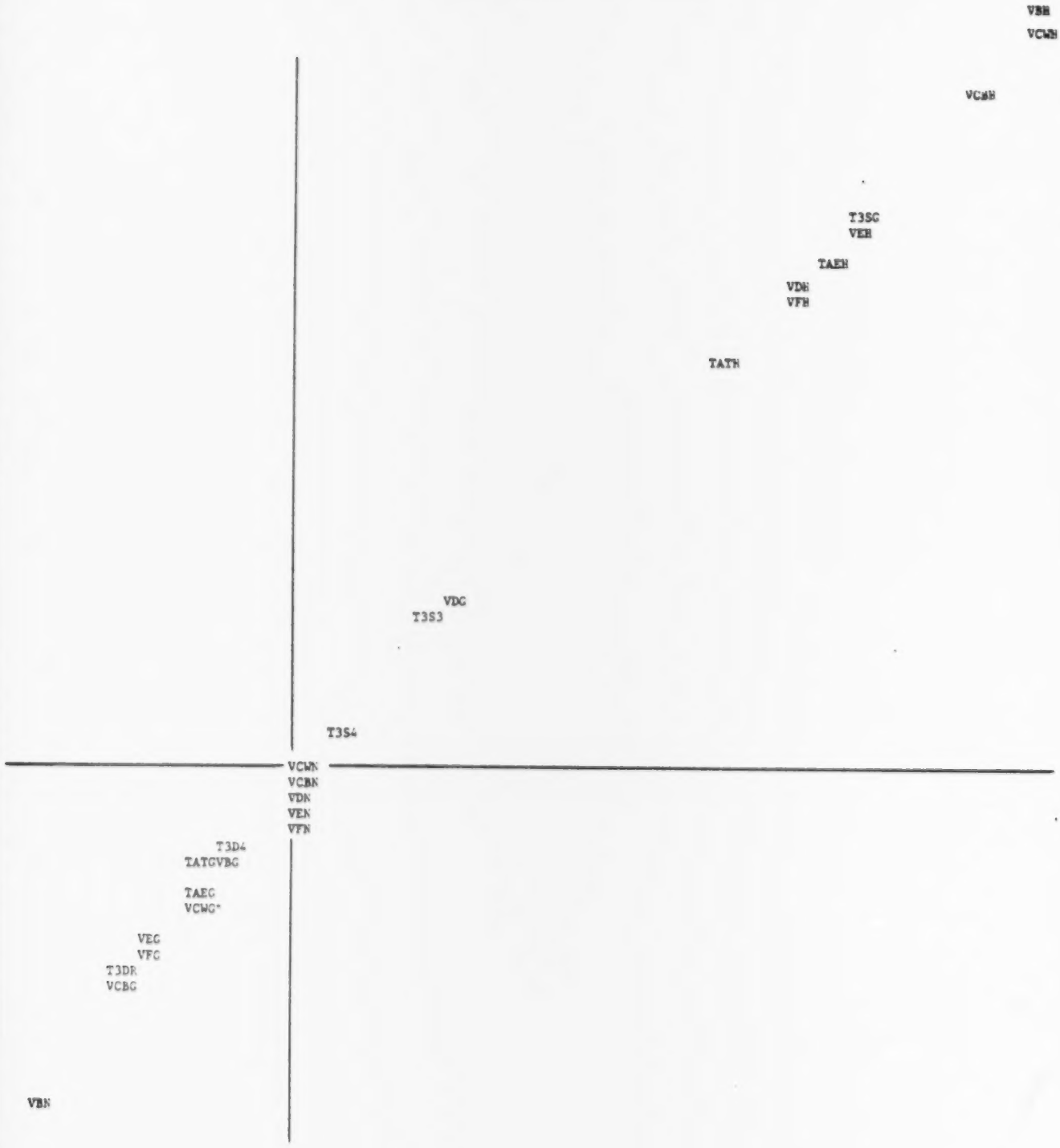

FIGURE 4.12: CORRESPONDENCE ANALYSIS FOR THE B.Comm. FIELD OF STUDY (T3)

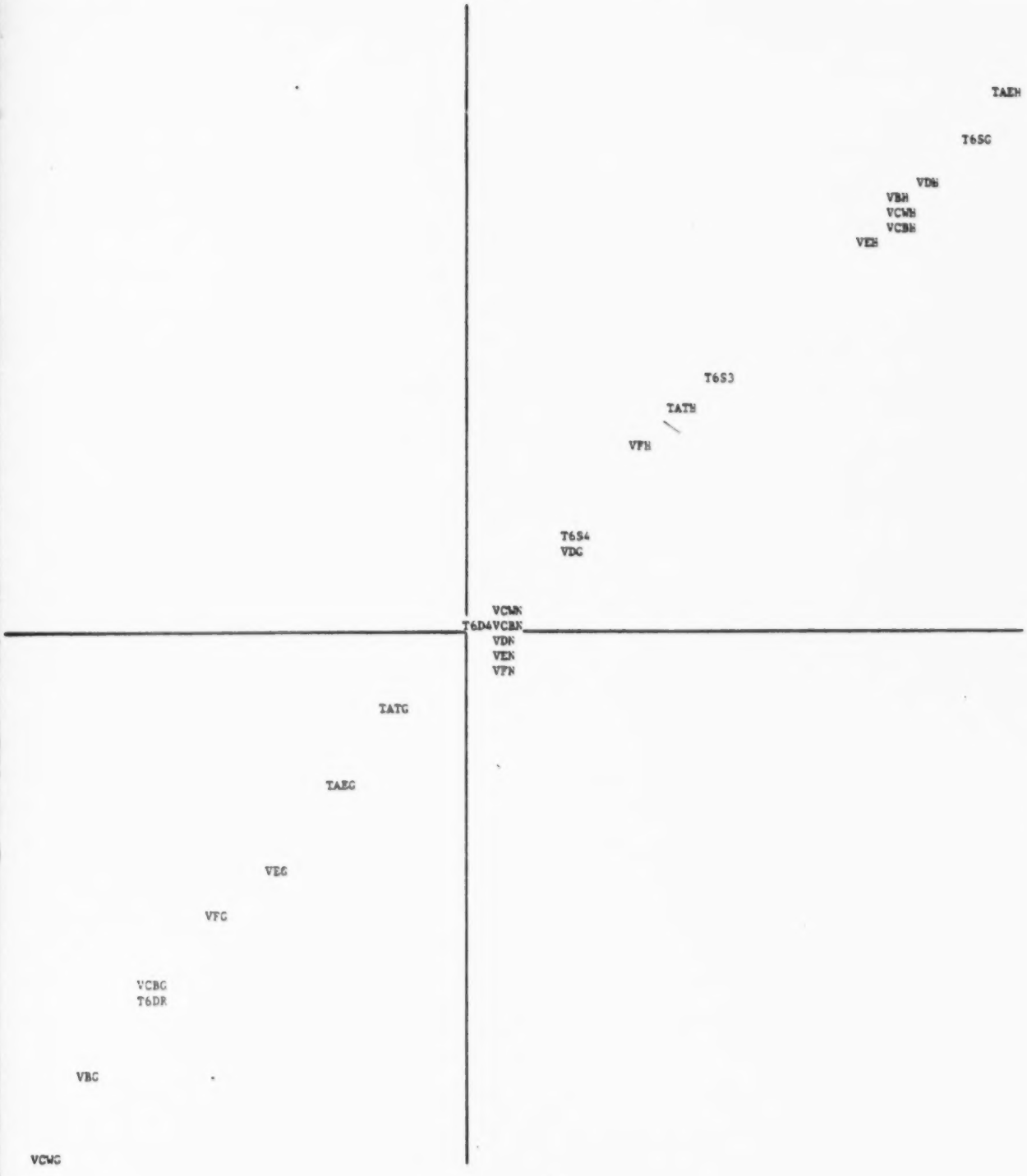

FIGURE 4.13: CORRESPONDENCE ANALYSIS FOR THE B.MED. FIELD OF STUDY (T6)

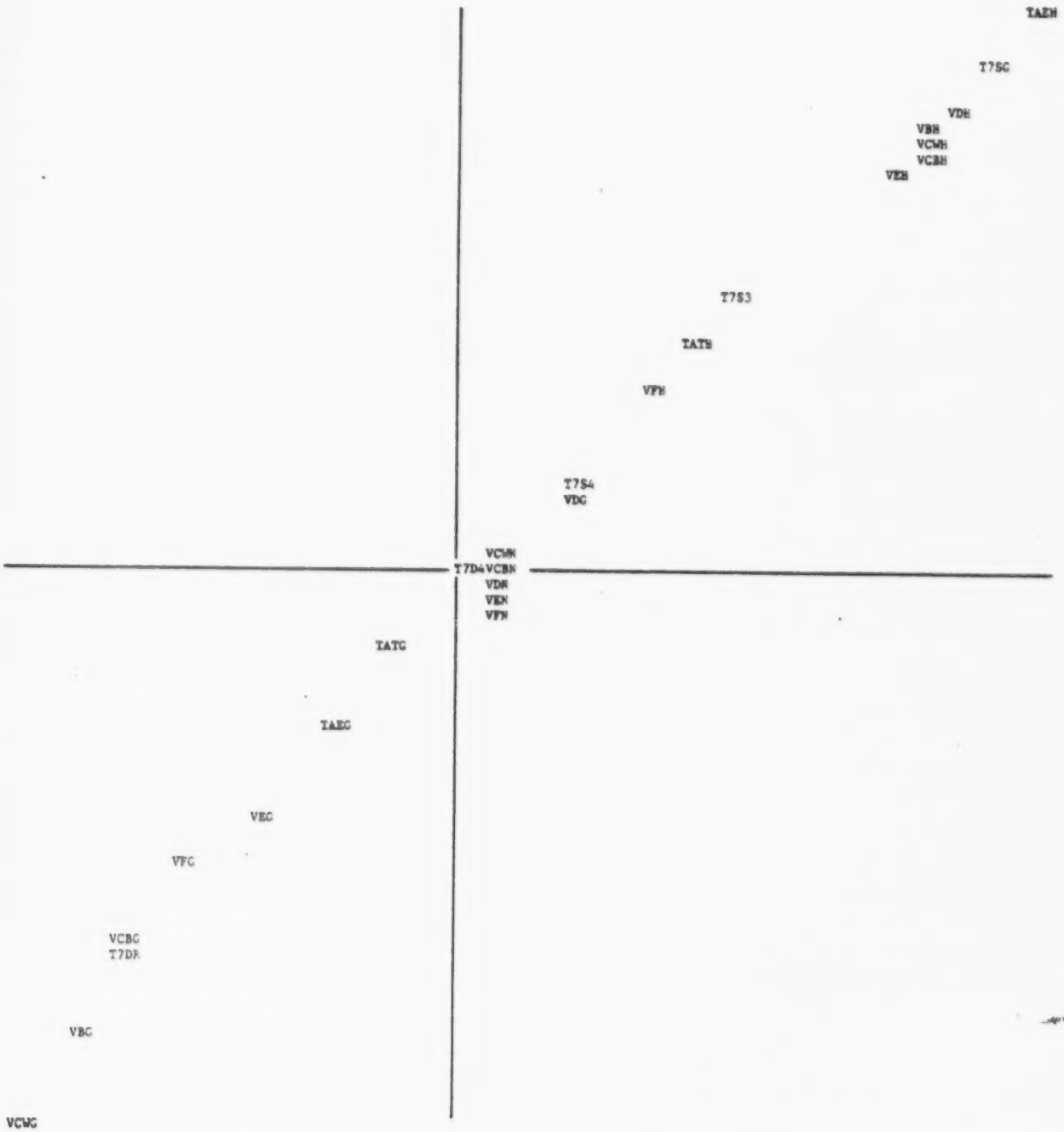

FIGURE 4.14: CORRESPONDENCE ANALYSIS FOR THE B.Sc.ENG. FIELD OF STUDY (T7)

school subject groups correspond with a poor achievement in the same study field (T.DR), should be good predictors of the degree of success that will be obtained in that study field (T.). It should be possible to use achievements in the school subjects or school subject groups as indicated below as predictors of the degree of success that can be expected in the different study fields:-

B.Sc.(Mathematics) field of study (Figure 4.8): Physical Science (VCW), Biology (VCB), Mathematics (VB), subject group E (VE) and second language (TAT).

B.Sc.(Non-Mathematics) field of study (Figure 4.9): Biology (VCB), Physical Science (VCW) and, to a lesser extent, Mathematics (VB) and subject group E (VE).

B.A.(Languages) field of study (Figure 4.10): Biology (VCB), subject group E (VE) and, to a lesser extent, first language (TAE) and subject group F (VF).

B.A.(Non-Languages) field of study (Figure 4.11): First language (TAE), subject group F (VF) and, to a lesser extent, second language (TAT) and subject group E (VE).

B.Comm. field of study (Figure 4.12): Subject group E (VE), Biology (VCB), subject group F (VF) and first language (TAE).

B.Med. field of study (figure 4.13): Biology (VCB), Mathematics (VB), Physical Science (VCW) and possibly subject group E (VE) and first language (TAE).

B.Sc.Eng. field of study (Figure 4.14): Mathematics (VB), Biology (VCB), Physical Science (VCW) and possibly subject group E (VE).

4.3.6 Identification of school subject group packages through discriminant analysis

Paragraph 4.3.5 dealt with the use of correspondence analysis to determine in respect of achievement which school subjects were associated the highest with successful university study. Stepwise discriminant analysis (see Appendix A, Par. A.2.5) can also be used for this purpose, namely to determine which variables are best able to distinguish or discriminate between successful, potentially successful and unsuccessful university study. With this in mind the students were divided into three groups according to their final achievement (see Par. 4.2.2(2)):

Group	Notation	Category values of final achievement
Unsuccessful	U	Final achievement = 1
Potentially successful	PS	Final achievement = 2 or 3
Successful	S	Final achievement = 4, 5 or 6

The reason for grouping final achievement = 2 or 3 (i.e. failure to comply with the criterion for successful study in four years and compliance with this criterion in four years) together, is because for most of the study fields the points ..D4 and ..S4 (for example T1D4 and T1S4) lie close together on the correspondence analysis graphs. (See Figures 4.8 to 4.14.)

The discriminant analyses were performed separately for the different study fields, with the following variables used as possible predictors (discriminators): school aggregate, school subject group (with scaled values for the achievement categories), effect of university (UNIV) and effect of examining body (EKSL). The discriminant analyses were repeated without school aggregate as a possible predictor.

The results of the discriminant analyses are indicated in Appendix B.

Interpretation of the discriminant analyses

The tables in Appendix B are self-evident. In the case of the B.Sc.(Mathematics) field of study, for instance, school aggregate discriminated the best between the three categories: unsuccessful, potentially successful and successful university study. Apart from school aggregate and the effects of university and examining body, achievement in Physical Science emerged as a further discriminator. When school aggregate was excluded as a predictor, achievements in Physical Science, Biology, subject group E subject(s) and Mathematics emerged as the best predictors (among the school subjects or school subject groups). The effects of university and examining body still remained present as discriminators between the categories indicated above of the degree of successful university study.

The B tables for the other university study fields can be interpreted similarly. In virtually all cases the variables UNIV (effect of university) and EKSL (effect of examining body) emerged as discriminators.

It is noticeable that the percentage of cases that were classified correctly in the categories unsuccessful and successful university study generally (with the medical field of study as the only actual exception) lie near one another and that this percentage was considerably higher than the percentage of cases that were classified correctly in the potentially successful category. The last mentioned percentage comes close to 33,3 % for various study fields, which is the percentage that would be obtained if students should be randomly assigned to the three categories. From the above it therefore appears that achievement in the school subjects can be used with reasonable success to distinguish between students who will drop out in university study and those who will be able to obtain the three-year degree or an equivalent qualification in three years. In the case of the medical field of study this also applies to the potentially successful category of students. For the other study fields there were evidently other factors in the case of the "average" achiever in the discriminatory school subjects in the final examination that played a role in determining whether a student would make a success of his university studies or not.

4.3.7 Regression analysis of final achievement

Regression analysis (see Appendix A, Par. A.2.2) were performed for the various university study fields, where categories of final achievement (see Par. 4.2.2(2)) were grouped together to obtain a dichotomous dependent variable. There are different possibilities when it comes to grouping together the categories of final achievement for this purpose, including (also see Par. 4.3.6):

I.	UNSUCCESSFUL	:	Category 1 of final achievement
	REST	:	Categories 2 to 6 of final achievement
II.	FAIL	:	Categories 1 and 2 of final achievement
	PASS	:	Categories 3 to 6 of final achievement
III.	SUCCESSFUL	:	Categories 4 to 6 of final achievement
	REST	:	Categories 1 to 3 of final achievement

Possibility II was eliminated immediately since the correspondence analyses had indicated that for the majority of the study fields a distinction could not be drawn between Categories 2 and 3 of final achievement on the basis of achievement in school subject groups (since for these study fields the points T.D4 and T.S4 lie close together on the correspondence analysis graph). This was actually confirmed by the discriminant analysis performed in this case.

Possibility III was eliminated because it was not considered meaningful to classify Category 3 of final achievement, namely successful in four years, as non-successful. Consequently the regression analyses were performed with the dependent variable a dichotomous variable having the categories unsuccessful (Category 1 of final achievement) and not unsuccessful (Categories 2 to 6 of final achievement).

This means therefore that the dropouts in the first study year (N.B.: not only in the first academic year) were classified against the non-dropouts in the first study year. (Of the three categories: unsuccessful, potentially successful and successful, as defined in Par. 4.3.6, the category unsuccessful also contained the most student cases for all study fields except the medical field of study.)

The following variables were used as possible explanatory variables in the regression analyses: school aggregate, achievements in school subject groups (with scaled values for the achievement categories of the school subject groups), universities (represented by dummy variables) and examining bodies (represented by dummy variables). The analyses were repeated without school aggregate as a possible explanatory variable.

Outcome of the regression analyses

B.Sc.(Mathematics) field of study: Among the school achievement parameters, school aggregate appeared to be a statistically highly significant explanatory variable. There were indications that Physical Science also contributed towards explaining the variation in the dependent variable. Without school aggregate as an explanatory variable, the most important explanatory variables appeared to be Mathematics, Physical Science, Biology and subject group E. With and without the inclusion of school aggregate in the analysis, a number of statistically highly significant explanatory variables were found among the universities and examining bodies. Taking into consideration the dichotomous nature of the dependent variable as well as the nature of the investigation, a relatively satisfactory value was obtained for the multiple correlation coefficient (R^2 = 0,28).

B.Sc.(Non-Mathematics) field of study: The most important explanatory variables among the school achievement parameters in this case appeared to be Mathematics, Biology and subject group E. This applied with and without the inclusion of school aggregate in the analysis. Furthermore, the differences between universities and between examining bodies could not be regarded as statistically significant. The value of the multiple correlation coefficient could be regarded as relatively satisfactory ($R^2 \approx 0,26$).

B.A.(Languages) field of study: With and without the inclusion of school aggregate, Biology appeared to be the strongest explanatory variable among the school achievement parameters. The second language as well as the third language possibly also contributed towards explaining the variation in the dependent variable when school aggregate was excluded from the analysis. The differences between universities did not appear to be statistically significant, but one of the examining bodies did contribute significantly towards explaining the variation. The value of the multiple correlation coefficient was relatively satisfactory ($R^2 \approx 0,27$).

B.A.(Non-Languages) field of study: The most important explanatory variables among the school achievement parameters here were school aggregate and possibly first language. (The second language was associated negatively with the dependent variable, which indicates that the second language should be excluded from the calculation of the school aggregate.) Without school aggregate the strongest predictors were first language and subject group F. There were statistically significant differences between a number of universities but not between examining bodies. The value of the multiple correlation coefficient was relatively low ($R^2 \approx 0,18$).

B.Comm. field of study: The strongest explanatory variable among the school achievement parameters appeared to be school aggregate, with a strong indication that the first language and the second language should be excluded from the calculation of the school aggregate (due to the negative associations). Without school aggregate in the analysis, the strongest explanatory variables appeared to be Biology, subject group E and subject group F, and possibly also Mathematics. With and without the inclusion of school aggregate in the analysis a number of statistically significant explanatory

variables occurred among the universities as well as among the examining bodies. The value of the multiple correlation coefficient can still be regarded as relatively satisfactory ($R^2 \approx 0,24$).

B.Med. field of study: The negative association between school aggregate and the dependent variable indicates that in this case only individual school subject groups should be taken as possible explanatory variables among the school achievement parameters. It appears that Physical Science, Biology, subject group E and subject group F were statistically significant explanatory variables. One of the universities and one of the examining bodies also emerged as statistically significant explanatory variables. The value of the multiple correlation coefficient was relatively satisfactory ($R^2 \approx 0,26$).

B.Sc.Eng. field of study: School aggregate did not emerge as an explanatory variable here, possibly because of the selection of students in this study field. The strongest explanatory variables among the school achievement parameters appeared to be Mathematics and Physical Science, and possibly also subject group E to a much smaller extent. The differences between universities and between examining bodies were not statistically significant. The value of the multiple correlation coefficient was also relatively satisfactory ($R^2 \approx 0,25$).

When the results of these regression analyses were compared with those of the discriminant analyses on final achievement (Par. 4.3.6 and Appendix B), the same tendencies were mainly found. The differences that were found can probably be accounted for by the fact that in the regression analyses a dichotomous dependent variable was considered, while in the discriminant analyses the categories of final achievement were divided into three groups.

4.3.8 Regression analysis of first-year achievement

Regression analyses (see Appendix A, Par. A.2.2) were performed for the different university study fields, with first-year achievement as measured by first-year mean percentage (see Par. 4.2.2(1)) used as the dependent variable. The following variables were used as possible explanatory variables: school aggregate, achievements in school subject groups (with scaled values for the achievement categories of the school subject groups), universities (represented by dummy variables) and examining bodies (represented by dummy variables). The analyses were repeated without school aggregate as a possible explanatory variable.

Outcome of the regression analyses

B.Sc.(Mathematics) field of study: Among the parameters for achievement in school subject groups, the achievements in school aggregate, Mathematics and Physical Science appeared to make a statistically highly significant contribution towards explaining the variation in first-year mean percentage. Without school aggregate as an explanatory variable, the achievements in Mathematics, Physical Science, Biology and subject group E emerged as strong explanatory variables. Statistically highly significant differences were found between the universities and between the examining bodies in respect of the school achievement that was required in order to obtain any particular expected first-year mean percentage. A relatively good value was obtained for the multiple correlation coefficient ($R^2 \approx 0,48$).

B.Sc.(Non-Mathematics) field of study: School aggregate did not emerge as an explanatory variable here. The important explanatory variables were achievements in Mathematics, Biology, subject group D and also to a much lesser extent in subject group E and in Physical Science. A number of possible statistically significant differences which may account for the variation in first-year mean percentage were found between the universities but not between the examining bodies. The value of the multiple correlation coefficient was relatively satisfactory ($R^2 \approx 0,39$).

B.A.(Languages) field of study: Among the school achievement parameters, the strongest explanatory variables appeared to be school aggregate, Biology and a third language. Without school aggregate, the second language, Physical Science, Biology, a third language and subject group E contributed most significantly towards explaining the variation in first-year mean percentages. Statistically highly significant differences were found as before between universities and less significant differences between examining bodies. The obtained value of the multiple correlation coefficient can be regarded as relatively good ($R^2 \approx 0,51$).

B.A.(Non-Languages) field of study: School aggregate, calculated without the marks obtained in the second language, appeared to be the strongest explanatory variable among the school achievement parameters. (Note that if school aggregate is included in the analysis, there was a strong negative correlation between the achievement in the second language and the

first-year mean percentage.) Without school aggregate the achievements obtained in the first language, in Biology and in subject groups E and F emerged as important explanatory variables. Statistically highly significant differences were also found between universities and less significant differences between examining bodies. The value of the multiple correlation coefficient was relatively low (R^2 = 0,34).

B.Comm. field of study: School aggregate emerged as an important explanatory variable here, with an indication that subject group F could also contribute towards explaining the variation in first-year mean percentages. Without school aggregate, the achievements in all school subjects excluding the first and second languages appeared to be important explanatory variables. Statistically highly significant differences were found between universities and less significant differences between examining bodies. The value of the multiple correlation coefficient was relatively satisfactory (R^2 = 0,43).

B.Med. field of study: School aggregate did not emerge as a statistically significant explanatory variable here either, in contrast to the achievements in Mathematics, Physical Science, Biology, a third language, subject group E and possibly also the achievement in subject group F. Statistically highly significant differences were found between universities as well as between examining bodies. The value of the multiple correlation coefficient was relatively less satisfactory (R^2 = 0,35).

B.Sc.Eng. field of study: Here also school aggregate did not emerge as an explanatory variable, in contrast to the achievements particularly in Mathematics, Physical Science and Biology. No statistically significant differences were found between universities, but in one case there was a highly significant difference between examining bodies. A relatively good value was found for the multiple correlation coefficient (R^2 = 0,52).

4.3.9 The most important school achievement parameters

In the preceding paragraphs different statistical analyses were discussed that were performed in order to identify the most important school achievement parameters, i.e. school achievement parameters that have statistically significant associations with university achievement. In terms of these school

achievement parameters it should therefore be possible on the one hand to evaluate the current minimum entrance requirements of universities and on the other hand to determine the effect of differentiated entrance requirements for the different study fields with a view to possibly supplementing the minimum entrance requirements in terms of school aggregate.

Four matters concerning the statistical analyses were at issue:

(i) University achievement was defined in terms of both first-year achievement and final achievement. In the above statistical analyses scaled values were assigned to the achievement categories (symbols) of the school subject groups. These scaled values were determined in such a way that the variation in university achievement, measured by the first-year achievement as well as by the final achievement, could best be explained.

(ii) Since it was found that in virtually all fields of study universities and examining bodies to a greater or lesser extent played a statistically significant role in explaining the variation in university achievement, it was necessary to retain the particular variables as explanatory variables in all the models in order to eliminate their effect on the correlation or association of university achievement with school aggregate and with the different school subject groups.

(iii) With a view to determining functions of the achievements in the school subject groups in terms of which university achievement in the different study fields could be predicted (which could possibly be used to supplement the minimum requirements in respect of school aggregate), the discriminant and regression analysis were also repeated with the exclusion of school aggregate as an explanatory variable.

(iv) With reference to (i) above, the regression analysis of final achievement (see Par. 4.3.7) and that of first-year achievement (see Par. 4.3.8) was also done by applying an amended method of scaling the achievement categories of the school subject groups (through the use of dummy variables to represent the achievement categories). First, for every university field of study an analysis of variance with achievements in school subject groups, university and examining body as factors, was done separately on final achievement and first-year achievement. The six achievement categories in each of the school subject groups were

used as the levels of this factor. The values of the six main effects for achievement in each of the school subject groups were used then as the scaled values of the achievement categories of the particular school subject group in the regression analysis. This method of scaling explains the maximum variation in the dependent variables final achievement and first-year achievement respectively. The square of the t statistic for the regression coefficient of each of the school subject groups was in fact the usual F statistic with five degrees of freedom that was used to test whether the particular school subject group had any effect on the dependent variable.

The regression analyses performed through this method of scaling the achievement categories of the school subject groups, produced virtually the same results as the regression analyses described in the preceding paragraphs.

Table 4.1 provides a summary of the results of the above statistical analyses for each of the university study fields considered. Only the most important (in the sense of statistically significant) school achievement parameters that play a role in explaining the variation in university achievement are indicated, either with an "X" or with the values of the regression coefficients of these school achievement parameters, as applicable.

From the table it appears that among the school achievement parameters, in more than one university study field school aggregate did not play a statistically significant role in predicting or explaining university achievement.

4.3.10 Possible criteria for admission to different university study fields

The present requirement for admission to university study is based mainly on the attainment of the minimum school aggregate mark of 950. Certain other requirements apply in respect of subjects that must be written for matriculation exemption and the grade at which the subjects must be passed with particular minimum symbols.

In par. 4.3.1 it was mentioned that the above entrance requirement did not discriminate adequately between successful and unsuccessful university students. Apart from school aggregate, the final examination marks obtained in one or more school subjects were the only parameters on the school study

TABLE 4.1

SUMMARY OF MOST IMPORTANT SCHOOL ACHIEVEMENT PARAMETERS

DEPENDENT VARIABLE	STUDY FIELD	EXPLANATORY VARIABLES								
		SGT	TAE	TAT	VKB	VKCW	VKCB	VKD	VKE	VKF
First-year achievement and final achievement (correspondence analysis without aggregate)	B.Sc.(Mathematics)	—		X	X	X	X		X	
	B.Sc.(Non-Mathematics)	—			X?	X	X		X?	
	B.A.(Languages)	—	X?				X		X	X?
	B.A.(Non-Languages)	—	X	X?					X?	X
	B.Comm.	—	X				X		X	X
	B.Med.	—	X?		X	X	X		X?	
	B.Sc.Eng.	—			X	X	X		X?	
Final achievement with three categories (discriminant analysis with inclusion of school aggregate)	B.Sc.(Mathematics)	X				X				
	B.Sc.(Non-Mathematics)	X								
	B.A.(Languages)	X	X				X			
	B.A.(Non-Languages)	X		X			X			
	B.Comm.	X		X						
	B.Med.	X				X	X		X	X
	B.Sc.Eng.	X			X	X				
Final achievement with three categories (discriminant analysis with exclusion of school aggregate)	B.Sc.(Mathematics)	—			X	X	X		X	
	B.Sc.(Non-Mathematics)	—	X		X				X	
	B.A.(Languages)	—	X				X	X	X	
	B.A.(Non-Languages)	—	X	X			X		X	
	B.Comm.	—			X	X	X	X	X	X
	B.Med.	—				X	X		X	X
	B.Sc.Eng.	—			X	X			X	
Final achievement with two categories (regression analysis with inclusion of school aggregate)	B.Sc.(Mathematics)	0,001				0,011		-0,018		
	B.Sc.(Non-Mathematics)				0,030		0,030		0,037	
	B.A.(Languages)						0,015			
	B.A.(Non-Languages)	0,001	0,012	-0,024						
	B.Comm.	0,001	-0,013	-0,020						
	B.Med.	-0,001		0,030	0,014	0,023	0,024		0,042	0,034
	B.Sc.Eng.				0,016	0,017				
Final achievement with two categories (regression analysis with exclusion of school aggregate)	B.Sc.(Mathematics)	—			0,011	0,017	0,012		0,015	
	B.Sc.(Non-Mathematics)	—			0,021		0,021		0,026	
	B.A.(Languages)	—		0,012			0,022	0,008		
	B.A.(Non-Languages)	—	0,024						0,018	
	B.Comm.	—			0,010		0,014		0,014	0,017
	B.Med.	—				0,015	0,015		0,030	0,026
	B.Sc.Eng.	—			0,015	0,017			0,015	
First-year average percentage (regression analysis with inclusion of school aggregate)	B.Sc.(Mathematics)	0,027			0,499	0,755	0,399			
	B.Sc.(Non-Mathematics)				1,145		0,807	1,266		
	B.A.(Languages)	0,019					0,483	0,524		
	B.A.(Non-Languages)	0,042		-1,129			0,382			
	B.Comm.	0,038		-0,459		0,400		0,684		0,411
	B.Med.	-0,020			0,826	1,121	0,734	1,309	1,212	0,739
	B.Sc.Eng.				0,986	0,650	0,721			
First-year average percentage (regression analysis with exclusion of school aggregate)	B.Sc.(Mathematics)	—			0,848	1,013	0,747		0,586	
	B.Sc.(Non-Mathematics)	—			1,122	0,712	0,784	1,248	0,694	
	B.A.(Languages)	—	0,295	0,505	0,311	0,551	0,754	0,670	0,423	0,370
	B.A.(Non-Languages)	—	0,960				0,778		0,794	0,761
	B.Comm.	—			0,539	0,743	0,634	1,005	0,664	0,898
	B.Med.	—			0,554	0,893	0,488	1,081	0,883	0,528
	B.Sc.Eng.	—			1,115	0,786	0,856		0,583	

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record that were readily available and in terms of which better discrimination between successful and unsuccessful university students could probably be obtained. There were various non-exclusive possibilities for bringing about better discrimination, for instance the differentiated raising of the minimum school aggregate for certain university study fields; compliance with certain minimum requirements in respect of school aggregate as well as other school subjects that are highly associated with final achievement, as defined earlier; or compliance with certain minimum requirements only in respect of particular school subjects.

First the data set was checked for the effect that the raising of the school aggregate as minimum entrance requirement for the different university study fields would have on the degree of successfulness of university study. In Table 4.2 the percentage of student cases from the data set that complied with the different categories of final achievement (as defined in Par. 4.2.2(2)) as a function of the school aggregate obtained, are indicated for the different study fields. The notation [1 450 - 1 650) for school aggregate, for instance, indicates that a total of at least 1 450 but less than 1 650 was obtained. For the B.Sc.(Mathematics) field of study 24,2 % of the students had a school aggregate in the category [1 450 - 1 650), of whom 86 % passed the first study year in two years (obtained at least the category value 2 of final achievement), 52 % obtained the degree in three or four years (at least the category value 3 of final achievement), 31 % obtained the degree in three years (at least the category value 4 of final achievement) and 6 % obtained it in three years with a final year percentage of at least 65 (at least the category value 5 of final achievement). The rest of the table can be interpreted in the same way.

From Table 4.2 the following inter alia appears:-

- Of the students with a school aggregate of less than 1 050 (50 %) who
  - .. enrolled for the B.Sc. degree, none obtained the degree in three years, but 12 % (Mathematics field) and 6 % (non-Mathematics field) did obtain it within four years;
  - .. enrolled for the B.A. degree, 16-18 % obtained the degree in three years and 23 % (Languages field) and 34 % (non-Languages field) obtained it within four years;
  - .. enrolled for the B.Comm. degree, 6 % obtained the degree in three years and 15 % obtained it within four years.

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TABLE 4.2

PERCENTAGE OF STUDENT CASES WHO OBTAINED AT LEAST THE INDICATED CATEGORY VALUE OF FINAL ACHIEVEMENT

Study field	School aggregate obtained	Percentage of student cases	Category value of final achievement obtained				
			1	2	3	4	5
B.Sc.(Mathematics)	[950-1 050)	7,6	100	30	12	0	0
	[050-1 250)	22,2	100	48	20	6	1
	[250-1 450)	29,5	100	65	31	13	4
(N = 838)	[450-1 650)	24,2	100	86	52	31	6
	[650-1 850)	11,0	100	91	64	48	17
	[850-	5,5	100	96	70	59	35
B.Sc.(Non-Mathematics)	[950-1 050)	6,0	100	19	6	0	0
	[050-1 250)	28,4	100	44	19	3	0
	[250-1 450)	29,8	100	73	46	21	7
(N = 352)	[450-1 650)	24,4	100	81	50	29	13
	[650-1 850)	9,7	100	91	76	68	44
	[850-	1,7	100	100	33	33	33
B.A.(Languages)	[950-1 050)	15,0	100	41	23	16	1
	[050-1 250)	33,9	100	60	42	24	2
	[250-1 450)	26,4	100	73	58	42	8
(N = 772)	[450-1 650)	17,0	100	88	82	67	29
	[650-1 850)	6,4	100	98	80	65	37
	[850	1,3	100	100	90	60	60
B.A.(Non-Languages)	[950-1 050)	17,2	100	52	34	18	2
	[050-1 250)	40,7	100	67	44	28	6
	[250-1 450)	25,2	100	81	61	47	13
(N = 1109)	[450-1 650)	12,1	100	93	80	68	27
	[650-1 850)	3,9	100	93	81	74	44
	[850-	1,0	100	100	82	82	55
B.Comm.	[950-1 050)	12,5	100	35	15	6	0
	[050-1 250)	29,4	100	56	28	14	3
	[250-1 450)	30,5	100	75	46	24	5
(N = 1014)	[450-1 650)	18,2	100	91	73	49	10
	[650-1 850)	7,8	100	94	80	63	41
	[850	1,7	100	100	76	65	59
B.Med.	[950-1 050)	0	-	-	-	-	-
	[050-1 250)	1,2	100	60	60	60	20
	[250-1 450)	7,5	100	67	50	33	0
(N = 401)	[450-1 650)	34,2	100	86	62	36	3
	[650-1 850)	46,4	100	97	73	51	3
	[850-	10,7	100	100	63	5	1
B.Sc.Eng.	[950-1 050)	0,7	100	0	0	0	0
	[050-1 250)	7,1	100	35	3	0	0
	[250-1 450)	26,9	100	66	32	9	2
(N = 435)	[450-1 650)	37,0	100	78	41	16	8
	[650-1 850)	22,5	100	94	60	30	13
	[850-	5,8	100	100	88	60	44

. Of the students with a school aggregate of between 1 450 (69 %) and 1 650 (79 %) who

.. enrolled for the B.Sc. degree, approximately 30 % obtained the degree in three years and approximately 50 % obtained it within four years;

.. enrolled for the B.A. degree, approximately 67 % (i.e. two-thirds) obtained the degree in three years and approximately 80 % (i.e. four-fifths) obtained it within four years;

.. enrolled for the B.Comm. degree, approximately 50 % obtained the degree in three years and just more than 70 % obtained it within four years;

.. enrolled for the medical field of study, 36 % completed the three-year equivalent degree in three years and 62 % completed it within four years;

.. enrolled for the B.Sc.Eng. degree, 16 % completed the three-year equivalent degree in three years and 41 % completed it within four years.

The data set was subsequently checked to determine what the effect would be if admission to the different university fields of study was not based exclusively on school aggregate, but if the achievement in one function or other (called the discriminant function) of the percentages obtained in particular school subject groups was also taken into consideration. In Table 4.1 an indication is given, for each of the study fields, of the school subjects or school subject groups that should be included in such a discriminant function. Against this background the following discriminant functions were decided on:

B.Sc.(Mathematics) field of study

$$D = \frac{2{,}246(VB) + 4{,}180(VCW) + 4{,}150(VCB) + 2{,}922(VE)}{2{,}246 + 4{,}180 + 4{,}150 + 2{,}922}$$

B.Sc.(non-Mathematics) field of study

$$D = \frac{2{,}551(VB) + 3{,}820(VCB) + 2{,}212(VD) + 3{,}440(VE)}{2{,}551 + 3{,}820 + 2{,}212 + 3{,}440}$$

B.A.(Languages) field of study

$$D = \frac{1{,}984(VAE) + 4{,}743(VCB) + 2{,}385(VD) + 1{,}656(VE)}{1{,}984 + 4{,}743 + 2{,}385 + 1{,}656}$$

B.A.(non-Languages) field of study

$$D = \frac{3,815(VAE) + 3,928(VCB) + 5,172(VE) + 2,092(VF)}{3,815 + 3,928 + 5,172 + 2,092}$$

B.Comm. field of study

$$D = \frac{2,122(VB) + 2,957(VCW) + 3,204(VCB) + 5,229(VE) + 4,750(VF)}{2,122 + 2,957 + 3,204 + 5,229 + 4,750}$$

B.Med. field of study

$$D = \frac{2,561(VCW) + 3,168(VCB) + 2,982(VE) + 2,931(VF)}{2,561 + 3,168 + 2,982 + 3,931}$$

B.Sc. Eng. field of study

$$D = \frac{4,144(VB) + 3,385(VCW) + 3,654(VE)}{4,144 + 3,385 + 3,654}$$

Nota Bene

1) When a student did not take a subject from a school subject group that occurred in the particular formula, the coefficient of the subject group in the numerator and in the denominator of the formula was taken as equal to zero.

2) The notation VE, for instance, indicates the percentage(s) obtained in subject group E subject(s). The same applies to the other subject groups.

3) The coefficients (weights) used in the above formulas are the standardized t values of the regression coefficients of the particular school subject groups in the regression of final achievement (with appropriate combination of its categories) on school aggregate, achievements in school subject groups, universities and examining bodies.

Tables 4.3 to 4.9 were compiled in terms of the above discriminant functions. In these tables consideration was given to the separate effects as well as the combined effect of two different cut-off points in the value of the school aggregate with two different cut-off points in the value of the discriminant function. For the school aggregate the cut-off points 1 050 (a mean percentage of 50) and 1 150 (a mean percentage of approximately 55) were used in addition to the present minimum requirement of 950 (a mean percentage of approximately 45). For the discriminant function

TABLE 4.3

EFFECT OF ALTERNATIVE MINIMUM ENTRANCE REQUIREMENTS FOR THE B.Sc.(MATHEMATICS) FIELD OF STUDY

SCHOOL AGGREGATE (SGT)	DEGREE OF SUCCESSFUL-NESS*	DISCRIMINANT FUNCTION D < 50	50 ≤ D < 55	D ≥ 55	TOTAL
SGT < 1 050	U	42	1	2	45
	PS	18	0	0	18
	S	0	0	0	0
	T O T A L	60	1	2	63
1 050 ≤ SGT < 1 150	U	31	8	2	41
	PS	14	14	1	29
	S	1	1	0	2
	T O T A L	46	23	3	72
SGT ≥ 1 150	U	14	49	119	182
	PS	12	30	300	342
	S	2	7	164	173
	T O T A L	28	86	583	697
TOTALS	U	87	58	123	268
TOTALS	PS	44	44	301	389
TOTALS	S	3	8	164	175
T O T A L		134	110	588	832

TABLE 4.4

EFFECT OF ALTERNATIVE MINIMUM ENTRANCE REQUIREMENTS FOR THE B.Sc.(NON-MATHEMATICS) FIELD OF STUDY

SCHOOL AGGREGATE (SGT)	DEGREE OF SUCCESSFUL-NESS*	DISCRIMINANT FUNCTION D < 50	50 ≤ D < 55	D ≥ 55	TOTAL
SGT < 1 050	U	15	2	0	17
	PS	4	0	0	4
	S	0	0	0	0
	T O T A L	19	2	0	21
1 050 ≤ SGT < 1 150	U	18	4	4	26
	PS	11	6	1	18
	S	0	0	0	0
	T O T A L	29	10	5	44
SGT ≥ 1 150	U	14	23	54	91
	PS	4	13	101	118
	S	1	3	71	75
	T O T A L	19	39	226	284
TOTALS	U	47	29	58	134
TOTALS	PS	19	19	102	140
TOTALS	S	1	3	71	75
T O T A L		67	51	231	349

* U : Unsuccessful (Final achievement = 1)
PS : Potentially successful (Final achievement = 2 or 3)
S : Successful (Final achievement = 4, 5 or 6)

TABLE 4.5

EFFECT OF ALTERNATIVE MINIMUM ENTRANCE REQUIREMENTS

FOR THE B.A.(LANGUAGES) FIELD OF STUDY

SCHOOL AGGREGATE (SGT)	DEGREE OF SUCCESSFULNESS*	DISCRIMINANT FUNCTION			TOTAL
		D < 50	50 ≤ D < 55	D ≥ 55	
SGT < 1 050	U	48	11	7	66
	PS	19	4	4	27
	S	12	1	5	18
	T O T A L	79	16	16	111
1 050 ≤ SGT < 1 150	U	27	16	11	54
	PS	19	12	16	47
	S	10	11	9	30
	T O T A L	56	39	36	131
SGT ≥ 1 150	U	13	17	93	123
	PS	12	17	124	153
	S	4	15	226	245
	T O T A L	29	49	443	521
TOTALS	U	88	44	111	243
TOTALS	PS	50	33	144	227
TOTALS	S	26	27	240	293
T O T A L		164	104	495	763

TABLE 4.6

EFFECT OF ALTERNATIVE MINIMUM ENTRANCE REQUIREMENTS

FOR THE B.A.(NON-LANGUAGES) FIELD OF STUDY

SCHOOL AGGREGATE (SGT)	DEGREE OF SUCCESSFULNESS*	DISCRIMINANT FUNCTION			TOTAL
		D < 50	50 ≤ D < 55	D ≥ 55	
SGT < 1 050	U	81	8	1	90
	PS	50	14	2	66
	S	23	9	3	35
	T O T A L	154	31	6	191
1 050 ≤ SGT < 1 150	U	33	37	17	87
	PS	28	46	19	93
	S	15	23	12	50
	T O T A L	76	106	48	230
SGT ≥ 1 150	U	5	28	85	118
	PS	3	42	180	225
	S	5	35	298	338
	T O T A L	13	105	563	681
TOTALS	U	119	73	103	295
TOTALS	PS	81	102	201	384
TOTALS	S	43	67	313	423
T O T A L		243	242	617	1 102

* U : Unsuccessful (Final achievement = 1)
PS : Potentially successful (Final achievement = 2 or 3)
S : Successful (Final achievement = 4, 5 or 6)

TABLE 4.7

EFFECT OF ALTERNATIVE MINIMUM ENTRANCE REQUIREMENTS FOR THE B.COMM. FIELD OF STUDY

SCHOOL AGGREGATE (SGT)	DEGREE OF SUCCESSFULNESS*	DISCRIMINANT FUNCTION D < 50	50 ≤ D < 55	D ≥ 55	TOTAL
SGT < 1 050	U	81	1	0	82
	PS	35	1	0	36
	S	8	0	0	8
	TOTAL	124	2	0	126
1 050 ≤ SGT < 1 150	U	57	12	2	71
	PS	41	16	1	58
	S	13	7	0	20
	TOTAL	111	35	3	149
SGT ≥ 1 150	U	30	47	81	158
	PS	20	50	259	329
	S	9	16	220	245
	TOTAL	59	113	560	732
TOTALS	U	168	60	83	311
TOTALS	PS	96	67	260	423
TOTALS	S	30	23	220	273
TOTAL		294	150	563	1 007

TABLE 4.8

EFFECT OF ALTERNATIVE MINIMUM ENTRANCE REQUIREMENTS FOR THE MEDICAL FIELD OF STUDY

SCHOOL AGGREGATE (SGT)	DEGREE OF SUCCESSFULNESS*	DISCRIMINANT FUNCTION D < 50	50 ≤ D < 55	D ≥ 55	TOTAL
SGT < 1 050	U	0	0	0	0
	PS	0	0	0	0
	S	0	0	0	0
	TOTAL	0	0	0	0
1 050 ≤ SGT < 1 150	U	0	0	0	0
	PS	0	0	0	0
	S	1	0	0	1
	TOTAL	1	0	0	1
SGT ≥ 1 150	U	0	3	34	37
	PS	0	1	188	189
	S	2	1	169	172
	TOTAL	2	5	391	398
TOTALS	U	0	3	34	37
TOTALS	PS	0	1	188	189
TOTALS	S	3	1	169	173
TOTAL		3	5	391	399

* U : Unsuccessful (Final achievement = 1)
PS : Potentially successful (Final achievement = 2 or 3)
S : Successful (Final achievement = 4, 5 or 6)

TABLE 4.9

EFFECT OF ALTERNATIVE MINIMUM ENTRANCE REQUIREMENTS FOR THE B.Sc.Eng. FIELD OF STUDY

SCHOOL AGGREGATE (SGT)	DEGREE OF SUCCESSFULNESS*	DISCRIMINANT FUNCTION			TOTAL
		D < 50	50 ≤ D < 55	D ≥ 55	
SGT < 1 050	U	2	1	0	3
	PS	0	0	0	0
	S	0	0	0	0
	TOTAL	2	1	0	3
1 050 ≤ SGT < 1 150	U	3	0	0	3
	PS	1	0	0	1
	S	0	0	0	0
	TOTAL	4	0	0	4
SGT ≥ 1 150	U	5	16	78	99
	PS	4	8	233	245
	S	0	0	76	76
	TOTAL	9	24	387	420
TOTALS	U	10	17	78	105
TOTALS	PS	5	8	233	246
TOTALS	S	0	0	76	76
TOTAL		15	25	387	427

50 % and 55 % were used as the cut-off points. The analyses were performed only in respect of final achievement. The same division of the categories of final achievement as in Par. 4.3.6 was used, namely unsuccessful (U), potentially successful (PS) and successful (S) university study.

From each of Tables 4.3 to 4.9, i.e. for each of the university study fields, the percentages of unsuccessful as well as successful students who would have been affected by the different alternative entrance requirements in the sense that they would not have obtained university entrance, were calculated. Take the B.Sc.(Mathematics) field of study for example. An increase in the minimum required school aggregate from 950 to 1 050 would have affected 45 of the unsuccessful, 18 of the potentially successful but none of the successful students. For this total survey group a rise in the minimum required school aggregate to 1 150 would have affected 86 of the unsuccessful, 47 of the

*U : Unsuccessful (Final achievement = 1)
PS : Potentially successful (Final achievement = 2 or 3)
S : Successful (Final achievement = 4, 5 or 6)

B.Sc.(Mathematics) field of study: From Table 4.3 it follows

. Percentage of unsuccessful students that would have been affected:

	D < 50	D < 55	TOTAL
SGT < 1 050	15,7	16,0	16,8
SGT < 1 150	27,7	30,6	32,1
T O T A L	32,5	54,1	

Total percentage of unsuccessful students = 32,2

. Percentage of successful students that would have been affected:

	D < 50	D < 55	TOTAL
SGT < 1 050	0	0	0
SGT < 1 150	0,6	1,1	1,1
T O T A L	1,7	6,3	

Total percentage of successful students = 21,0

B.Sc.(Non-Mathematics) field of study: From Table 4.4 it follows

. Percentage of unsuccessful students that would have been affected:

	D < 50	D < 55	TOTAL
SGT < 1 050	11,2	12,7	12,7
SGT < 1 150	24,6	29,1	32,1
T O T A L	35,1	56,7	

Total percentage of unsuccessful students = 38,4

. Percentage of successful students that would have been affected:

	D < 50	D < 55	TOTAL
SGT < 1 050	0	0	0
SGT < 1 150	0	0	0
T O T A L	1,3	5,3	

Total percentage of successful students = 22,0

B.A.(Languages) field of study: From Table 4.5 it follows

. Percentage of unsuccessful students that would have been affected:

	D < 50	D < 55	TOTAL
SGT < 1 050	20,0	24,3	27,2
SGT < 1 150	30,9	42,0	49,4
T O T A L	36,2	54,3	

Total percentage of unsuccessful students = 31,9

. Percentage of successful students that would have been affected:

	D < 50	D < 55	TOTAL
SGT < 1 050	4,1	4,4	6,1
SGT < 1 150	7,5	11,6	16,4
T O T A L	8,9	18,1	

Total percentage of successful students = 38,4

B.A.(Non-Languages) field of study: From Table 4.6 it follows

. Percentage of unsuccessful students that would have been affected:

	D < 50	D < 55	TOTAL
SGT < 1 050	27,5	30,2	30,5
SGT < 1 150	38,6	53,9	60,0
T O T A L	40,3	65,1	

Total percentage of unsuccessful students = 26,8

. Percentage of successful students that would have been affected:

	D < 50	D < 55	TOTAL
SGT < 1 050	5,4	7,6	8,3
SGT < 1 150	9,2	16,5	20,1
T O T A L	10,2	26,0	

Total percentage of successful students = 38,4

B.Comm. field of study: From Table 4.7 it follows

. Percentage of unsuccessful students that would have been affected:

	D < 50	D < 55	TOTAL
SGT < 1 050	26,0	26,4	26,4
SGT < 1 150	44,4	48,6	49,2
T O T A L	54,0	73,3	

Total percentage of unsuccessful students = 30,1

. Percentage of successful students that would have been affected:

	D < 50	D < 55	TOTAL
SGT < 1 050	2,9	2,9	2,9
SGT < 1 150	7,7	10,3	10,3
T O T A L	11,0	19,4	

Total percentage of successful students = 27,1

B.Med. field of study: From Table 4.8 it follows

. Percentage of unsuccessful students that would have been affected:

	D < 50	D < 55	TOTAL
SGT < 1 050	0	0	0
SGT < 1 150	0	0	0
T O T A L	0	8,1	

Total percentage of unsuccessful students = 9,3

. Percentage of successful students that would have been affected:

	D < 50	D < 55	TOTAL
SGT < 1 050	0	0	0
SGT < 1 150	0,6	0,6	0,6
T O T A L	1,7	2,3	

Total percentage of successful students = 43,4

B.Sc.Eng. field of study: From Table 4.9 it follows

. Percentage of unsuccessful students that would have been affected:

	D < 50	D < 55	TOTAL
SGT < 1 050	1,9	2,9	2,9
SGT < 1 150	4,8	5,7	5,7
T O T A L	9,5	25,7	

Total percentage of unsuccessful students = 24,6

. Percentage of successful students that would have been affected:

	D < 50	D < 55	TOTAL
SGT < 1 050	0	0	0
SGT < 1 150	0	0	0
T O T A L	0	0	

Total percentage of successful students = 17,8

potentially successful and only two of the successful students. Compared to this the required $D \geq 50$ would have affected 87 of the unsuccessful, 44 of the potentially successful and three of the successful students, while the required $D \geq 55$ would have affected 145 of the unsuccessful, 88 of the potentially successful and 11 of the successful students. The tables above indicate the percentages of unsuccessful as well as successful students that would have been affected had the above criteria been applied separately and collectively for each of the university study fields tabled, with the percentages calculated in terms of the total number of unsuccessful and successful students for each of the study fields respectively. If the school aggregate had been raised to 1 050 for instance as the general minimum entrance requirement for university study, the following percentages of unsuccessful and successful students would have been affected:

Study field	Percentages of unsuccessful students that would have been affected	Percentages of successful students that would have been affected
B.Sc.(Mathematics)	16,8	0,0
B.Sc.(Non-Mathematics)	12,7	0,0
B.A.(Languages)	27,2	6,1
B.A.(Non-Languages)	30,5	8,3
B.Comm.	26,4	2,9
B.Med.	0,0	0,0
B.Sc.Eng.	2,9	0,0

The total percentages of students that would have been affected by an increase in the school aggregate to 1 050 are as follows for the different study fields:

Study field	Total percentage of students that would have been affected
B.Sc.(Mathematics)	7,6
B.Sc.(Non-Mathematics)	6,0
B.A.(Languages)	14,5
B.A.(Non-Languages)	17,3
B.Comm.	12,5
B.Med.	0,0
B.Sc.Eng.	0,7

Minimum entrance requirements for the different study fields that were based on the various discriminant functions instead of on school aggregate would have affected considerably larger percentages of unsuccessful students, but likewise also larger percentages of successful students.

4.3.11 General comment

Students with a first-year average achievement of less than 5 % were excluded from all the statistical analyses. The reason for this is that many beginner first-year students who have the potential to make a success of university study drop out of university early during the first academic year for non-academic reasons. If this criterion were not applied, the percentage of variation in the dependent variable university achievement explained in the regression analyses, would be reduced considerably. The numbers of students affected in this way were as follows for the different study fields:

Study field	Number of students	Total number of students
B.Sc.(Mathematics)	180	1 018
B.Sc.(Non-Mathematics)	44	396
B.A.(Languages)	96	868
B.A.(Non-Languages)	182	1 291
B.Comm.	107	1 121
B.Med.	11	412
B.Sc.Eng.	48	483
TOTAL	668	5 589

In the above total number of students the B.Sc.(Ed.), B.A.(Ed.), B.Comm.(Ed.), B.Admin., B.Paed, and B.Prim.Ed. students as well as the teaching diploma students were not taken into consideration.

4.4 STATISTICAL ANALYSIS AND MODEL BUILDING IN THE CASE OF TECHNIKON STUDY[1)]

4.4.1 Introduction

Final achievement was regarded as the dependent variable with categories as defined in Par. 4.2.3. In the model building process a distinction was drawn between the following study fields:

- Biological sciences
- Medical technology
- Physical sciences
- Engineering technology
- Commerce and management
- Art and design

With final achievement as dependent variable a CHAID analysis (see Appendix A, Par. A.2.1(1)) was performed first with the following explanatory variables (predictors): technikon study field, school aggregate, sex, age, technikon, examining body, home language, year in which Standard 10 was passed, medium of school instruction, matriculation exemption or not and population group. For this analysis school aggregate was transformed as follows into a categorical variable:

1) Owing to the small number of students, the two technikons for Blacks were treated as one institution in the analyses.

Category	Category value
SGT < 900	1
900 ≤ SGT < 1 050	2
1 050 ≤ SGT < 1 200	3
1 200 ≤ SGT	4

In the first step of the CHAID analysis the following probabilities of exceedance correspond with each of the above predictors:

Predictor	Probability of exceedance (%)
Study field	2.692E-17
School aggregate	6.079E-15
Sex	0.0417
Age	100,0
Technikon	8.768E-126
Examining body	1.371E-53
Home language	3.947E-53
Year of matriculation	0.2626
Medium of school instruction	1.702E-45
Matriculation exemption or not	1.808E-9
Population group	6.627E-32

From the above CHAID analysis it therefore appears that technikon is associated the highest with final achievement.[1] The second step of the CHAID analysis indicates that in 50 % of the categories of technikon study field was associated the highest with final achievement, whereas in the other half of these categories school aggregate emerged as the best predictor of final achievement. In the cases where school aggregate emerged as the best predictor in the second step, study field emerged as the most important predictor of final achievement in the third step. This points to an interaction between technikon, school aggregate and study field in the prediction of final achievement, which made it necessary to consider the different study fields separately in the statistical analyses and model building.

Figures 4.15 to 4.20 indicate respectively the CHAID analyses for the study fields biological sciences, medical technology, physical sciences, engineering technology, commerce and management and art and design. It appears that technikon was the best predictor of final achievement in the case of all the study fields. It also appears that school aggregate was the second best predictor in the case of engineering technology and commerce and management.

[1] On account of inadequate information in respect of the variables one technikon was excluded from the CHAID and regression analyses.

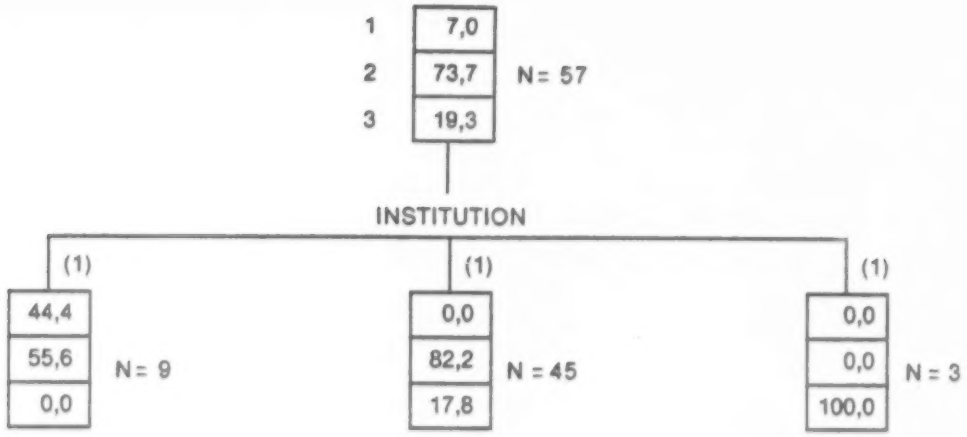

FIGURE 4.15: CHAID ANALYSIS OF FINAL ACHIEVEMENT FOR THE BIOLOGICAL SCIENCES FIELD OF STUDY (TECHNIKONS)

FIGURE 4.16: CHAID ANALYSIS OF FINAL ACHIEVEMENT FOR THE MEDICAL TECHNOLOGY FIELD OF STUDY (TECHNIKONS)

*) "(2)" means, for example, that two institutions are grouped together in this branch.

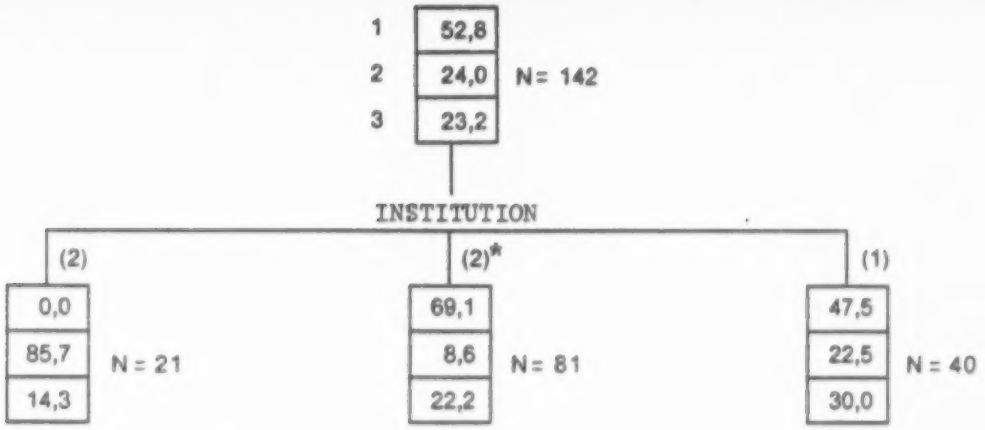

FIGURE 4.17: CHAID ANALYSIS OF FINAL ACHIEVEMENT FOR THE PHYSICAL SCIENCES FIELD OF STUDY (TECHNIKONS)

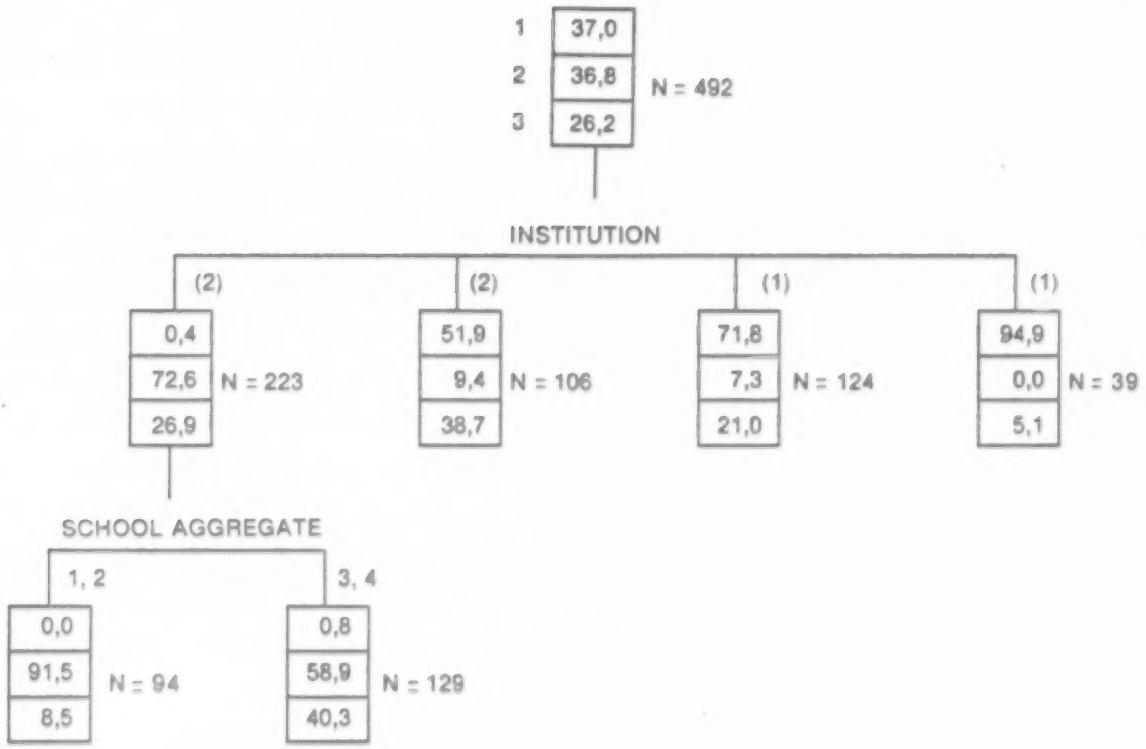

FIGURE 4.18: CHAID ANALYSIS OF FINAL ACHIEVEMENT FOR THE ENGINEERING TECHNOLOGY FIELD OF STUDY (TECHNIKONS)

*) "(2)" means, for example, that two institutions are grouped together in this branch.

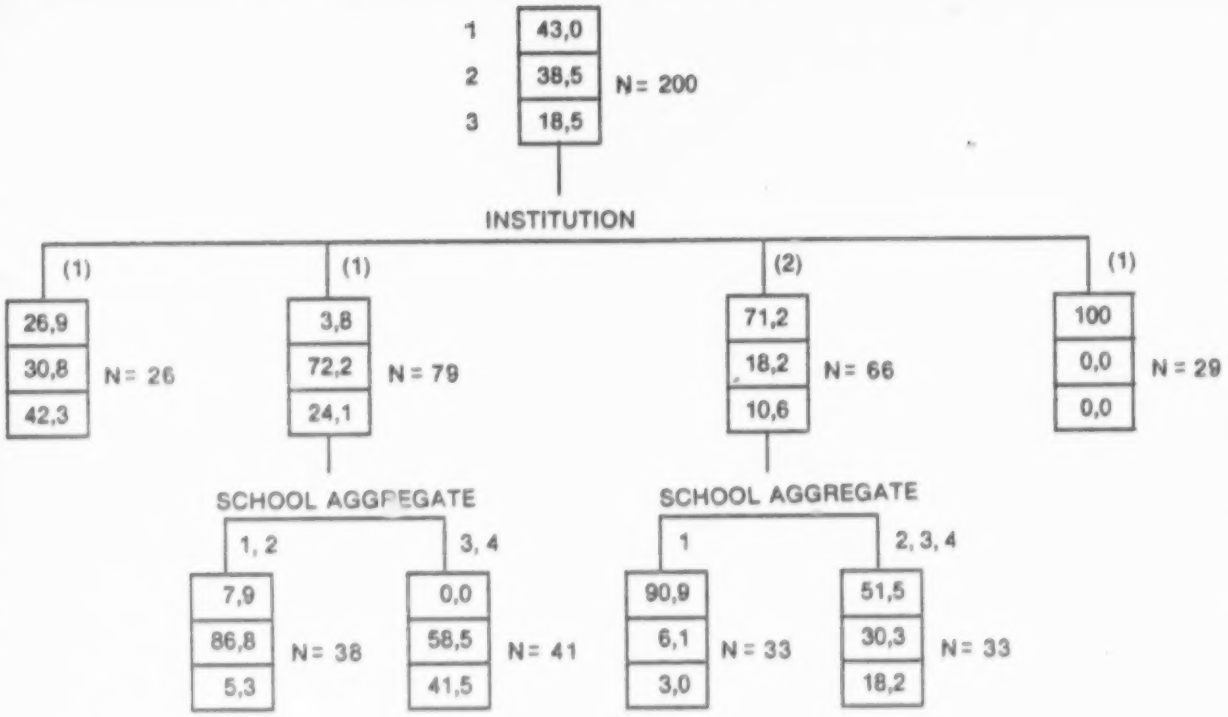

FIGURE 4.19: CHAID ANALYSIS OF FINAL ACHIEVEMENT FOR THE COMMERCE AND MANAGEMENT FIELD OF STUDY (TECHNIKONS)

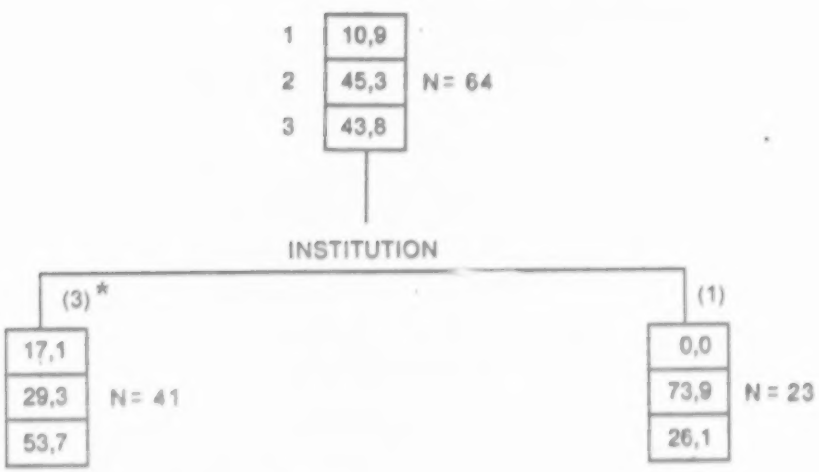

FIGURE 4.20: CHAID ANALYSIS OF FINAL ACHIEVEMENT FOR THE ART AND DESIGN FIELD OF STUDY (TECHNIKONS)

*) "(3)" means, for example, that three institutions are grouped together in this branch.

However the number of students per study field was relatively small in general, with the result that no further meaningful subdivisions could be performed with the CHAID analysis.

In the case of the biological sciences field of study only four persons failed, and all of them were at one technikon. It is interesting to note that matriculation exemption was evidently not a significant predictor of achievement. It should be borne in mind, however, that this predictor is confounded with school aggregate.

4.4.2 Scaling of the achievements in school subject groups

Scaled real values were obtained for the achievement categories of the different school subject groups through correspondence analyses. These real values were subsequently used as the values of the school subject group variables, in discriminant and regression analyses. Scaling was done only in respect of the categorical dependent variable final achievement as defined in Par. 4.2.3.

Graphic representations of the three study fields for which the great majority of students have enrolled, are given in Figures 4.21 to 4.23. As row variable for the contingency table, technikon final achievement with the categories 1 : DRUI, 2 : S<60 and 3 : S>60 (cf. Par. 4.2.3), was used. As column variable for the contingency table, achievements in school subject groups with categories

TAEH, TAEG, TATH, TATG, VBH, VBG, VBN,...,VFH, VFG, VFN,

were used.

The interpretation of these symbols is explained in Par. 4.3.4 with the following exceptions: An H after the symbol for school subject group in this case indicates that at least 50 % was obtained in such a subject and a G that less than 50 % was obtained. VCB refers to Biology and VCW to Physical Science.

Interpretation: Figures 4.21 to 4.23 indicate the relative positions of the categories of technikon final achievement and how these positions are related to the achievements in the different school subject groups. Note that the achievement of at least 50 % in a school subject was taken as high (the symbol H) in the case of technikon study. A comparison of Figures 4.21 to 4.23 and 4.8 to 4.14 indicates that successful completion of the theoretical examinations in the case of all three technikon study fields was related to considerably lower school achievements than those for successful university study.

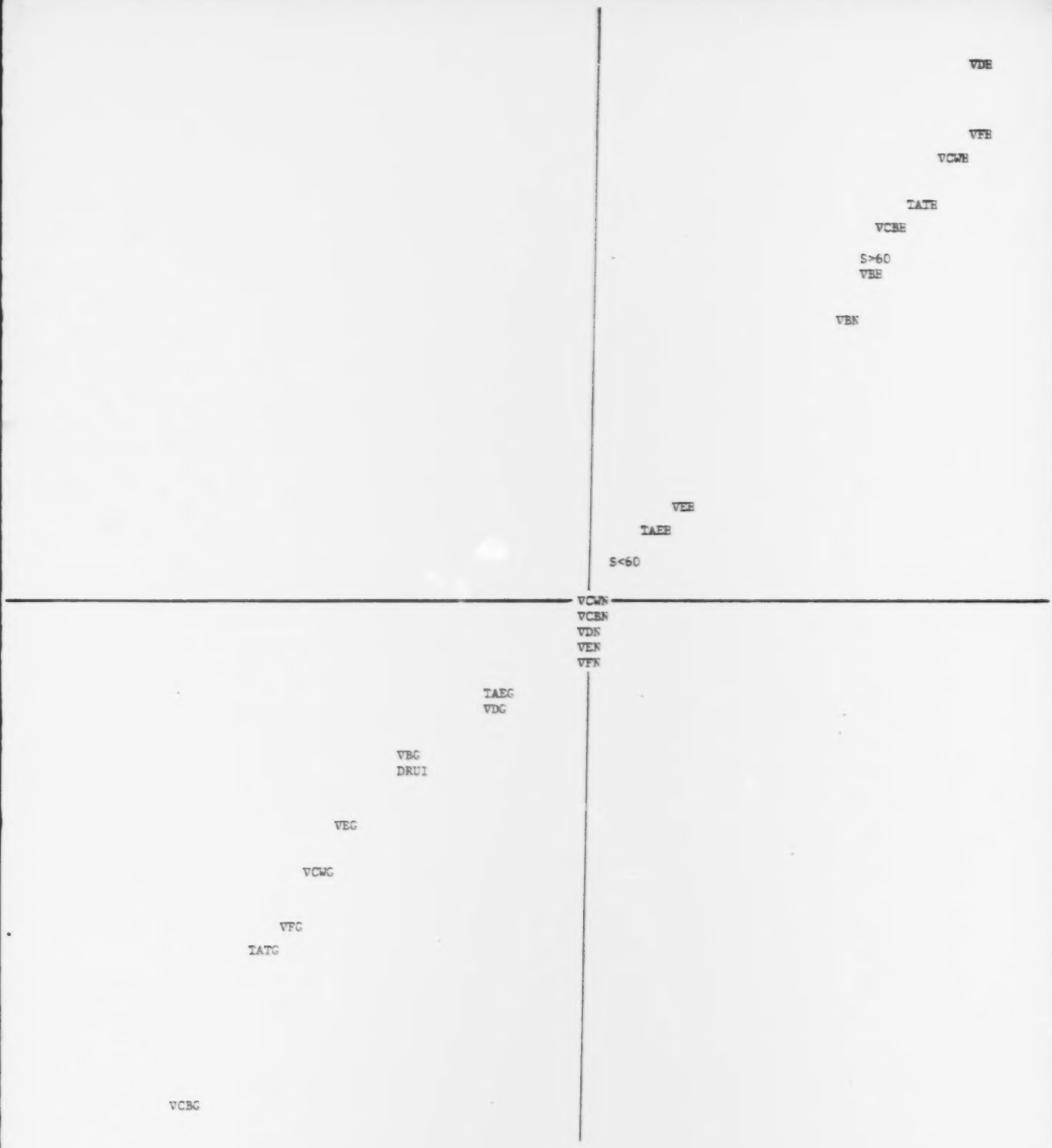

FIGURE 4.21: CORRESPONDENCE ANALYSIS FOR TECHNIKON STUDY FIELD — PHYSICAL SCIENCES

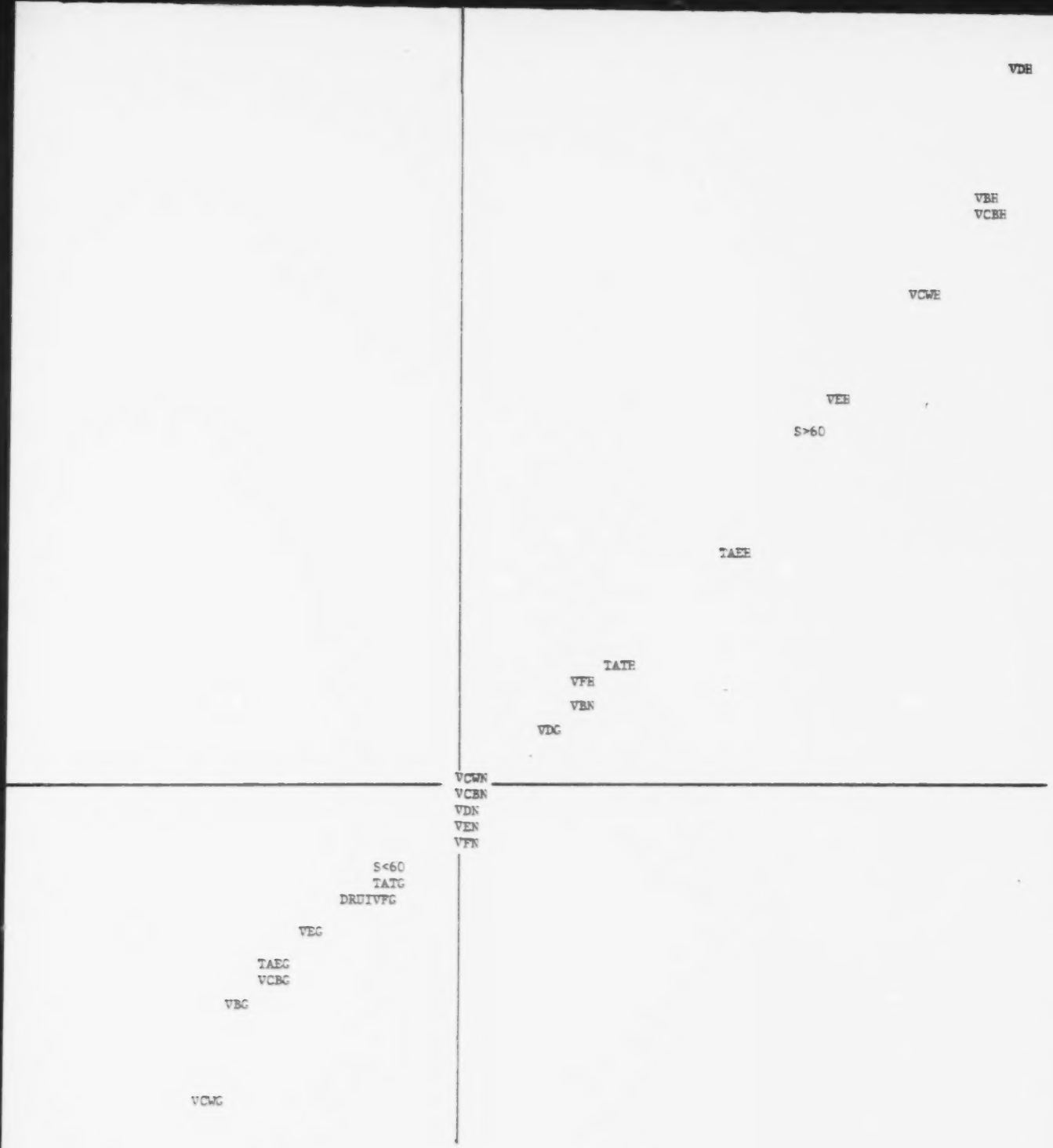

FIGURE 4.22: CORRESPONDENCE ANALYSIS FOR TECHNIKON STUDY FIELD — ENGINEERING TECHNOLOGY

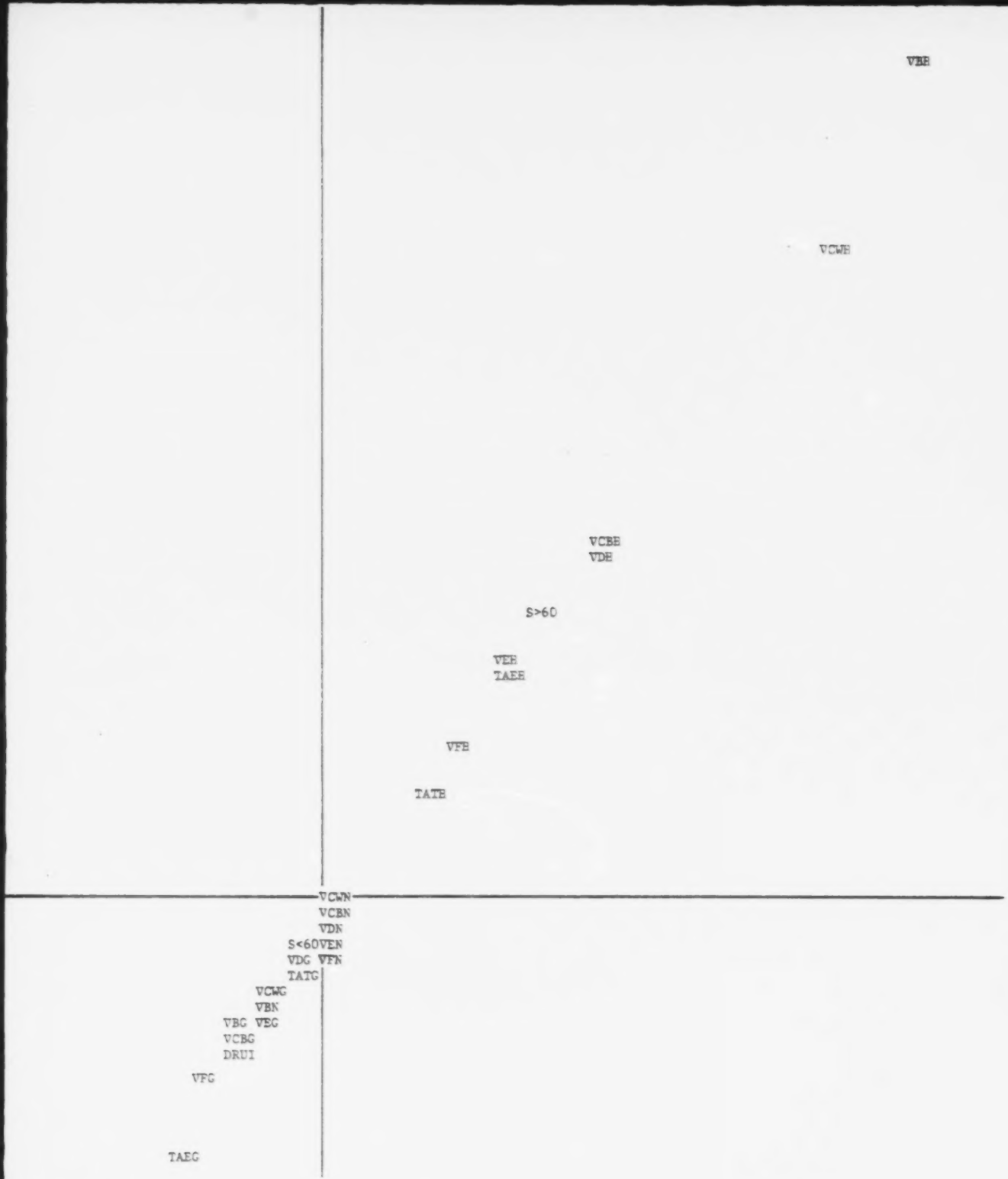

FIGURE 4.23: CORRESPONDENCE ANALYSIS FOR TECHNIKON STUDY FIELD — COMMERCE AND MANAGEMENT

4.4.3 Discriminant analysis

Stepwise discriminant analysis (see Appendix A, Par. A.2.5) was used to determine which of the variables were best able to distinguish or discriminate between technikon students who had failed, technikon students who had complied with the theoretical requirements for a diploma within not more than six separate examination sessions with a mean percentage of less than 60 and technikon students who had complied with the theoretical requirements with a mean percentage of 60 or higher, within six examination sessions at the most. With a view to the above, students were divided into three groups according to their final achievement (see Par. 4.2.4), namely

Group	Notation
Failed	DR
Passed, percentage < 60	SG
Passed, percentage ≥ 60	SH

The discriminant analyses were performed separately for the different study fields with the following variables used as possible predictors (discriminators): school aggregate, school subjects, effect of technikon (TECH) and effect of examining body (EKSL). The discriminant analyses were repeated without school aggregate as a possible predictor. The results of the discriminant analyses are given in Appendix B, Tables B.8 to B.13.

Interpretation of the discriminant analyses

The tables in Appendix B speak for themselves. It is noticeable that technikon (TECH) and examining body (EKSL) emerged as respectively the best and second best discriminators in all the technikon study fields with the exception of the art and design field of study. School aggregate did not emerge as a discriminator. It should be borne in mind that the school aggregate was very homogeneous in respect of technikon students, whereas the different school subject combinations evidently had a greater variation and therefore discriminated better. Consequently the discriminant analyses produced identical results with or without school aggregate. The percentage of failures that were correctly classified were generally very high. It appears, however, that the discrimination between the categories SG and SH of the variable final achievement was relatively poor. It should be remembered that the final achievement was defined in such a way that the number of examination sessions was not taken into account as a distinguishing parameter.

4.4.4 Regression analysis of final achievement

Regression analyses (see Appendix A, Par. A.2.2) were performed for the different technikon study fields whereby final achievement was transformed as follows into a dichotomous variable.

Final achievement	Category	Value
Failed	DR	0
Passed, percentage < 60	SG	1
Passed, percentage ≥ 60	SH	

Since the discriminant analyses showed that there was good discrimination between DR and the groups SG and SH, but relatively poor discrimination between SG and SH, the above choice of dichotomization appeared to be meaningful.

The following variables were used as possible explanatory variables in the regression analyses: school aggregate, achievements in the different school subject groups, technikons (represented by dummy variables) and examining bodies (represented by dummy variables). On the basis of the information obtained from the CHAID analyses no further explanatory variables were used. The analyses were repeated without school aggregate as a possible explanatory variable.

Outcome of the regression analyses

- Biological sciences field of study: The only significant explanatory variables were technikon (see CHAID analysis Figure 4.15) and examining body. Because of the small sample size, however, it would not be meaningful to use this result for future prediction. ($R^2 \cong 0{,}58$).

- Medical technology field of study: Mathematics, Biology, school subject group F and to a lesser extent technikon appeared to be good predictors of success. In this case, however, the sample size was also relatively small. ($R^2 \cong 0{,}58$).

- Physical sciences field of study: Significant predictors of success in this study field were SGT, first language, second language, Mathematics, Biology, school subject group F, technikon and examining body. ($R^2 \cong 0{,}54$).

- **Engineering technology field of study:** Significant predictors for this field were Mathematics, school subject groups D and F and technikon. (R^2 ≈ 0,56).

- Commerce and management field of study: The strongest predictor of success was technikon and to a lesser extent school subject group F. (R^2 ≈ 0,63).

- Art and design field of study: School subject groups E and F were statistically significant predictors of success. For this study field the sample size was also relatively small. (R^2 ≈ 0,54).

It is noticeable that SGT plays a relatively small role as predictor of success in the case of technikon study.

4.5 STATISTICAL ANALYSIS AND MODEL BUILDING IN THE CASE OF TEACHER TRAINING COLLEGE STUDY

4.5.1 Introduction

Final achievement was considered as the dependent variable with categories as defined in Par. 4.2.4. In the model building process a distinction was drawn between the following study fields:

- Primary education field (including the preprimary and primary education diploma courses and the B.Prim.Ed. degree).
- Secondary education field (including the secondary education diploma and certificate courses).

The teacher training colleges were grouped together mainly on the basis of controlling education departments and homogeneity of syllabuses. A meaningful combination appeared to be seven groups.

With final achievement as dependent variable CHAID analyses (see Appendix A, Par. A.2.1(1)) were performed with the following explanatory variables (predictors): teacher training college group, matriculation exemption or not, school aggregate, sex, age, examining body, home language, year in which Standard 10 was passed, medium of instruction and population group. For these analyses school aggregate was transformed as follows into a categorical variable:

Category	Category value
SGT < 900	1
900 ≤ SGT < 1 050	2
1 050 ≤ SGT < 1 200	3
1 200 ≤ SGT	4

Figures 4.24 and 4.25 respectively indicate the CHAID analyses for the primary and secondary education fields. In the case of primary education, school aggregate was the best predictor of final achievement. Further predictors of final achievement were teacher training college group, school language medium, examining body, home language and age. These variables were therefore included in the regression and discriminant analyses.

With regard to the secondary education field, it appears that teacher training college group was the best predictor of final achievement. Further predictors were sex, age and year in which the Standard 10 examination was passed. These variables were therefore included in the regression and discriminant analyses.

4.5.2 Scaling of the achievements in school subject groups

Scaled real values were obtained for the achievement categories of the different school subject groups through correspondence analyses. These real values were subsequently used as the values of the school subject group variables in discriminant and regression analyses. Scaling was performed only in respect of the categorical dependent variable final achievement as defined in Par. 4.2.4.

4.5.3 Discriminant analysis

Stepwise discriminant analysis (see Appendix A, Par. A.2.5) was used to determine which variables were best able to distinguish or discriminate between teacher training college students who did not obtain the diploma/certificate/B.Prim.Ed. degree in four years and those who were able to obtain it in four years. With a view to this the students were divided into two groups according to their final achievement (see Par. 4.2.4), namely

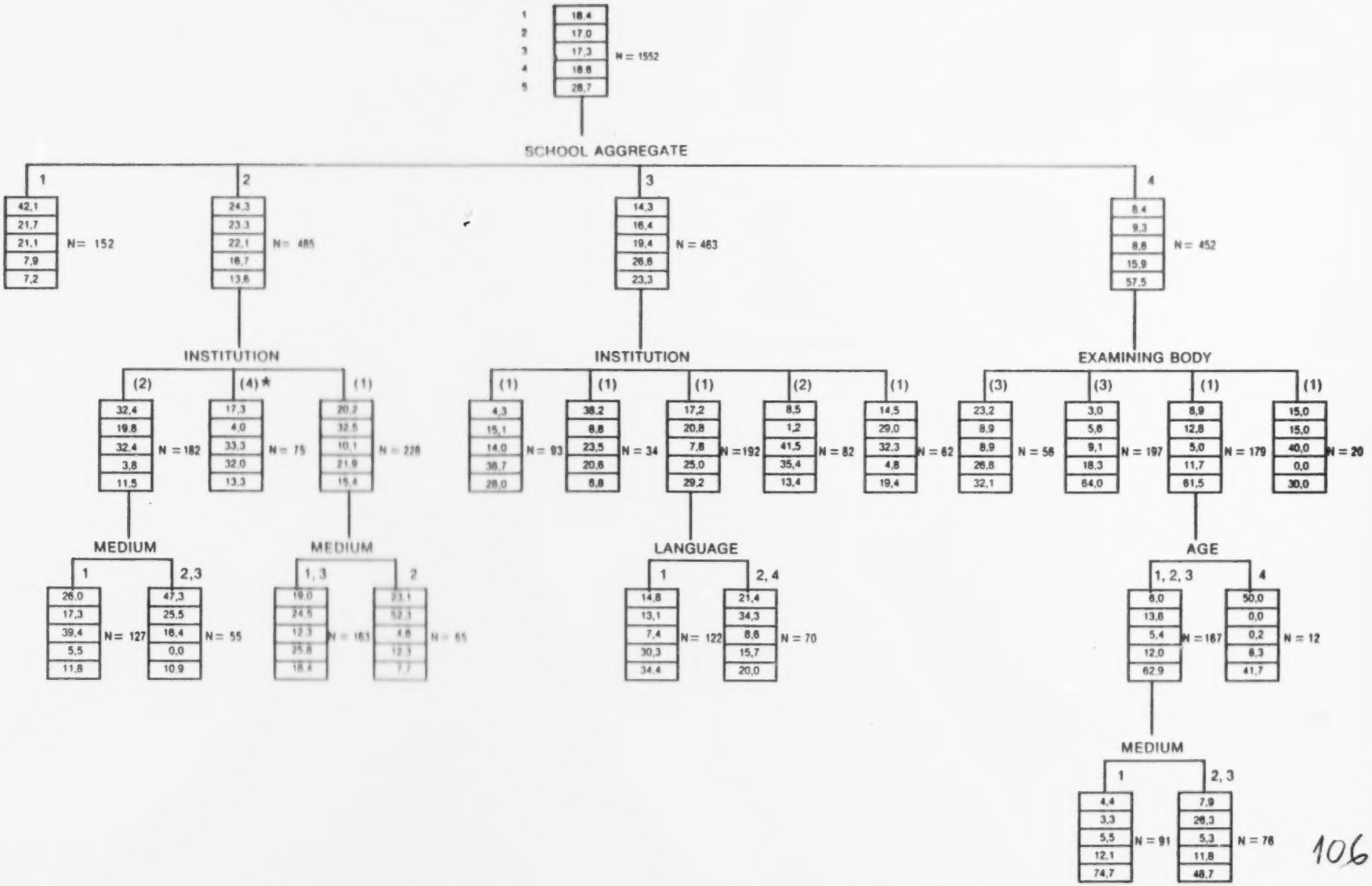

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FIGURE 4.24: CHAID ANALYSIS OF FINAL ACHIEVEMENT FOR THE PRIMARY STUDY FIELD (TEACHER TRAINING COLLEGES)

*)"(4)" means, for example, that four institutions are grouped together in this branch. The same applies to examining body.

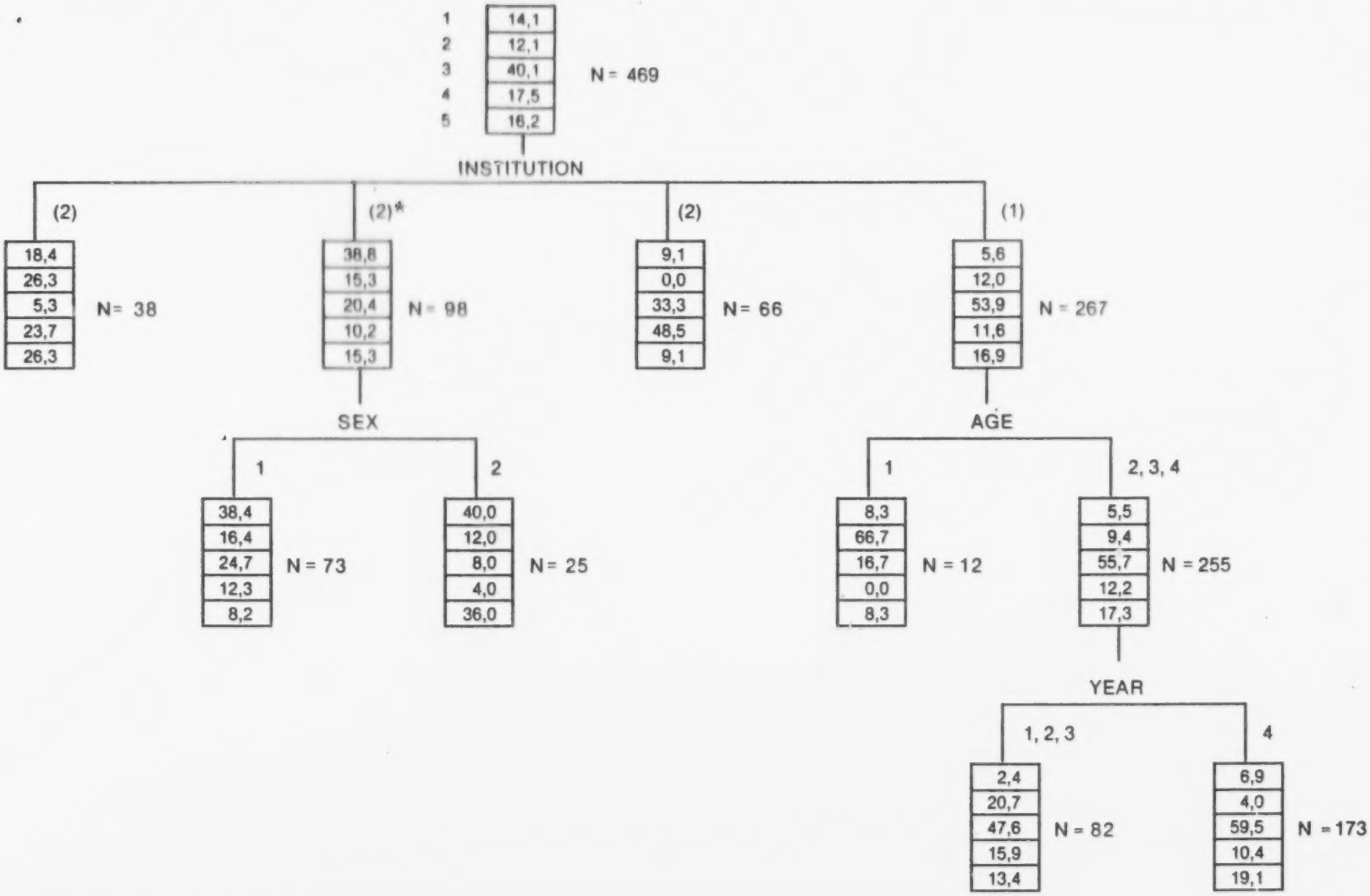


FIGURE 4.25: CHAID ANALYSIS OF FINAL ACHIEVEMENT FOR THE SECONDARY STUDY FIELD (TEACHER TRAINING COLLEGES)

*) "(2)" means, for example, that two institutions are grouped together in this branch.

Group	Notation
Failed: Categories 1 and 2 of final achievement	DR
Passed: Categories 3, 4 and 5 of final achievement	SL

The discriminant analyses were performed separately for the two study fields (education fields) and the following variables were used as possible predictors (discriminators) in both cases: school aggregate, school subjects, effect of teacher training college groups (KOLL) and effect of examining bodies. In the case of the primary education field the variables school language medium, home language and age were considered as additional predictors. In the case of the secondary education field the variables sex, age and year in which the Standard 10 examination was passed, were considered additionally. The discriminant analyses were repeated without school aggregate as a possible predictor.

Interpretation of the discriminant analyses

The results are indicated in Appendix B, Tables B.14 and B.15 and are self-explanatory.

- Primary education field: Without school aggregate the discriminators for the groups DR and SL were first and second language, subject groups E and F, school language medium, teacher training college group and examining body. The percentage classified correctly was 69,0. The discriminant analysis with school aggregate included indicated that school aggregate, second language, teacher training college group, school language medium and examining body were the discriminators for the groups DR and SL. The percentage classified correctly was 69,8.

- Secondary education field: Without school aggregate the discriminators for the groups DR and SL were school achievements in Mathematics and Biology, as well as teacher training college group and examining body. The percentage classified correctly was 63,4. School aggregate replaced the school achievements in Mathematics and Biology when the discriminant analysis was performed including school aggregate. The percentage classified correctly was 68,1.

4.5.4 Regression analysis of final achievement

Regression analyses (see Appendix A, Par, A.2.2) were performed for the two education fields with final achievement (see Par. 4.2.4) transformed as follows into a dichotomous variable.

Final achievement category	Value
1, 2	0
3, 4, 5	1

As possible explanatory variables the following variables were used in the regression analyses: school aggregate, achievements in the different school subject groups, teacher training college groups (represented by dummy variables) and examining bodies (represented by dummy variables). On the basis of the information obtained from the CHAID analyses the following variables were used additionally in the analysis of the primary education field: age, school language medium (represented by dummy variables) and home language (represented by dummy variables). In the case of the secondary education field the following additional variables were used: sex (represented by a dummy variable), age, home language (represented by dummy variables) and year in which the Standard 10 examination was passed. The analyses were also repeated without school aggregate as a possible explanatory variable.

Outcome of the regression analyses

- Primary education course: Without school aggregate, the significant predictors of final achievement were first and second language, school subject groups E and F, teacher training college group, examining body and school language medium. With school aggregate included in the regression analysis, only the second language, teacher training college group and school language medium were significant. ($R^2 \cong 0,21$).

- Secondary education course: Without school aggregate, the statistically significant predictors of final achievement were Biology, teacher training college group and examining body. With school aggregate included in the analysis, the predictors of final achievement were teacher training college group and examining body. ($R^2 \cong 0,26$).

In all the regression analyses the values of the multiple correlation coef= ficient were relatively low, but nevertheless satisfactory if one takes into consideration the dichotomous nature of the dependent variable.

4.6 STATISTICAL ANALYSIS AND MODEL BUILDING IN THE CASE OF NURSING STUDIES

4.6.1 Introduction

The training colleges for nurses were grouped together according to the controlling bodies. Because of their relatively small numbers the training institutions of the independent states were grouped along with those of the national states. Final achievement was considered as the dependent variable with categories as defined in Par. 4.2.5. In the model building process only the general nursing study field was considered.

A CHAID analysis (see Appendix A, Par. A.2.1(1)) was performed with the following explanatory variables (predictors): school aggregate, sex, age, training institution (see grouping of training institutions in Par. 3.4, Table 3.4), examining body, home language, year in which Standard 10 examination was passed, school language medium and population group. For this analysis school aggregate was transformed as follows into a categorical variable:

Category	Category values
SGT < 900	1
900 ≤ SGT < 1 050	2
1 050 ≤ SGT < 1 200	3
1 200 ≤ SGT	4

The CHAID analysis is given in Figure 4.26. It appears that home language was the best predictor of final achievement. In the second step school aggre= gate emerged as a predictor of final achievement.

4.6.2 Scaling of the achievements in the school subject groups

Scaled real values were obtained for the achievement categories of the different school subject groups through correspondence analyses. These real values were subsequently used as the values of the school subject group variables in discri= minant and regression analyses.

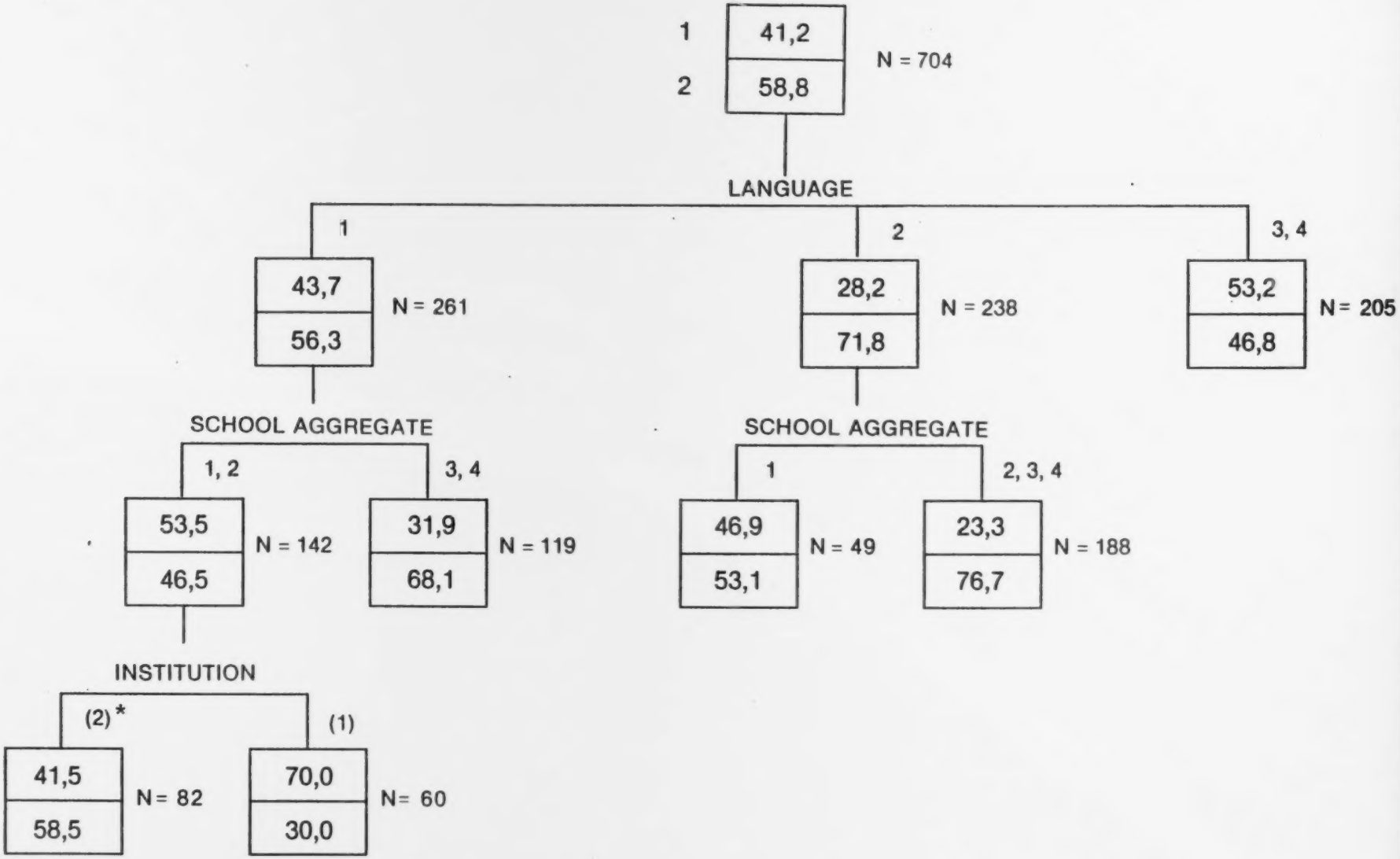


FIGURE 4.26: CHAID ANALYSIS OF FINAL ACHIEVEMENT FOR THE GENERAL NURSING FIELD OF STUDY

*) "(2)" means, for example, that two institutions are grouped together in this branch.

Scaling was performed only in respect of the categorical dependent variable final achievement as defined in Par. 4.2.5.

4.6.3 Discriminant analysis

Stepwise discriminant analysis (see Appendix A, Par. A.2.5) was used to determine which of the variables were best able to distinguish or discriminate between students who were unable to obtain a diploma and those who did obtain a diploma in a period of four years at most. The symbols DR and SL were used respectively to indicate groups that failed and passed.

The discriminant analysis was performed with the following variables as possible predictors (discriminators): school aggregate, school subjects, effect of training institution (VERPL), effect of examining body (EKSL) and effect of home language (TAAL). The discriminant analysis was repeated without school aggregate as a possible predictor. The results of the discriminant analyses are given in Appendix B, Table B.16.

Interpretation of the discriminant analyses

When school aggregate was included as a predictor, it appeared that the most important predictors of successful nursing studies were the following variables: examining body, home language, school aggregate, Mathematics and training institution. The coefficient in the linear discriminant function associated with the variable Mathematics was the converse of the signs of the other coefficients. The regression analysis (see Par. 4.6.4) also indicated a negative correlation between Mathematics and final achievement. With school aggregate excluded as a predictor, the following variables were obtained as discriminators for the groups DR and SL: examining body, home language, school subject group E, training institution, first language, Mathematics and Biology. The percentage of correct classifications was 64,5 and 62,9 respectively for the discriminant analyses with and without school aggregate.

4.6.4 Regression analysis of final achievement

A regression analysis (see Appendix A, Par. A.2.2) was performed on the dichotomous dependent variable (see Par. 4.2.5) final achievement.

The following variables were used as possible explanatory variables in the regression analysis: school aggregate, achievements in the different school subject groups, training institutions (represented by dummy variables), examining bodies (represented by dummy variables) and home language (represented by dummy variables). The regression analysis was repeated without the explanatory variable school aggregate.

Outcome of the regression analyses

- With school aggregate: The statistically significant predictors of final achievement were first language, Mathematics (negative correlation), school subject group E and home language. The multiple correlation coefficient was very low, however, which indicates that there are other factors that also determine successful study, but that these factors were not taken into account in this investigation ($R^2 \cong 0,12$).

- Without school aggregate: The same statistically significant predictors as above were found again, except that school subject group E now emerged more strongly as a predictor of final achievement ($R^2 \cong 0,12$).

CHAPTER 5

INTERPRETIVE SUMMARY

5.1 GENERAL

In the light of the statement of the problem (Chapter 1), the synopsis of previous research (Chapter 2), the planning of the investigation and the realization of the sample (Chapter 3) and the statistical analyses (Chapter 4), a summary is now given of the results of the investigation. However, because of the complexity of the investigation, the summary should not be interpreted in isolation, but rather against the background of the complete analysis.

In certain respects this investigation differs from those mentioned in Chapter 2.

- Where previous investigations focused on only one form of tertiary education, this investigation was concerned with universities, technikons, teacher training colleges and nursing colleges.
- Where previous investigations were often limited to a single institution (university, technikon, teacher training college, nursing college), this investigation involved all the above groups of tertiary institutions. Information obtained from 16 universities, 9 technikons, 35 teacher training colleges and 80 nursing colleges was used in the investigation.
- Where previous investigations concerned mainly White students, this investigation involved students of all the population groups.
- Most of the previous investigations concentrated only on students' success in their first study year, while here the complete study record of the students was taken into consideration.
- In order to take factors such as differentiated syllabuses into account and to utilize the SAPSE system, the target group consisted only of students who had enrolled at a tertiary institution for the first time in 1980. However, the analysis of a single intake has its limitations.

A variety of statistical techniques, including techniques for the analysis of categorical data, were used supplementarily so that realistic success prediction

models could be developed. In some cases these models appeared to account for a relatively low percentage of the variation in study success. It should be borne in mind, however, that no provision could be made in the model building process for certain important variables such as hostel residence or not, the educational level of students' parents, students' intelligence coefficients, aptitude, interests, study habits and attitudes, participation in sports and cultural activities, etc.

5.2 THE EFFECT OF RAISING THE REQUIRED MINIMUM SCHOOL AGGREGATE FOR MATRICULATION OR MATRICULATION EXEMPTION AND THE POSSIBILITY OF CHANNELLING

The effect that the raising of the required minimum school aggregate for university entrance would have had on student numbers and study success in the different university study fields can be deduced from Table 5.1. Table 5.1 contains information on 6 284 university students. The possibilities of chanelling students to other forms of tertiary study and the expected success with such channelling can be deduced from Table 5.2. It should be pointed out that although in Table 5.1 provision is made in the category "< 1 050" for students with a school aggregate of less than 950 marks, there were few such cases.

If the required minimum school aggregate of the 1980 student intake had been 1 050 instead of 950, 828 of the students (i.e. 13,2 % of the 6 284 students) would not have obtained university entrance. It appears that 19 % of these 828 students (i.e. 2,5 % of the 6 284 students) were in fact successful in their university study, and would thus have missed the opportunity of obtaining a degree in three or four years. From Table 5.2, however, it appears that 58 % of the technikon students in the school aggregate interval [950, 1 050) were successful compared with the corresponding 19 % for universities. The corresponding percentages for teacher training colleges and nursing colleges were 60 and 53 respectively.

A further analysis of the students concerned in the interval [950, 1 050) at university, indicates that only 9 % of the B.Sc.(Mathematics) students and 12 % of the B.Sc.(Non-Mathematics) students were successful, while none of the students concerned were successful in the B.Med. and B.Sc.Eng. fields of study. At a technikon, however, the possibility of such students obtaining their

qualifications is estimated at 90 % in the biological sciences field, 57 % in the engineering technology field, 31 % in the physical sciences field and 42 % in the medical technology field. Similarly, the estimated chance of success at a teacher training college is 56 % in the primary education field and 73 % in the secondary education field, while the corresponding figure for successful study at a nursing college is 53 %.

Raising the required minimum school aggregate from 950 to 1 050 marks would therefore have eliminated a small percentage of successful university students "unfairly", while the three other forms of tertiary study would have offered these students a greater opportunity for achieving study success.

The effect of raising the required minimum school aggregate to even 1 150 marks, can be determined in the same way.

5.3 DIFFERENTIAL ENTRANCE REQUIREMENTS FOR DIFFERENT FORMS OF TERTIARY STUDY

This investigation confirmed the frequent finding of previous research that of all the independent variables taken into consideration, in most cases school aggregate contributes the most towards explaining the variation in tertiary study success. For each of the study fields it was shown however that the Standard 10 achievement in a particular combination of school subjects is reasonably able to predict successful tertiary study. (See Par. 4.3.10.) These relationships could be useful in determining differential entrance requirements for the different tertiary study fields, either by way of a special note to this effect on the Standard 10/matriculation certificate (by the JMB) or through particular study field-specific faculty, training school or college entrance requirements determined individually or jointly by the respective universities, technikons, teacher training colleges and nursing colleges.

Apart from school aggregate it appears that tertiary institution and examining body account for most of the variation in tertiary study success and that there are indeed significant differences between examining bodies and between tertiary institutions as indicated in Chapter 4. The effect of school achievement should therefore be seen as an average effect over these two variables and by the same token a channelling model should be regarded as being effective on the average, i.e. the model is not necessarily the most efficient for any

specific institution or examining body. If feasible, different channelling models should be constructed for the respective combinations of tertiary institution and examining body, or else greater uniformity should be obtained in respect of these two variables.

TABLE 5.1

PERCENTAGE (P) OF THE NUMBER OF UNIVERSITY STUDENTS (N) IN DIFFERENT STUDY FIELDS WHO WERE SUCCESSFUL FOR GIVEN SCHOOL AGGREGATE VALUES

	School aggregate						
	< 1 050		[1 050,1 150)		> 1 150		TOTAL
	N	P	N	P	N	P	
B.Sc.(Mathematics)	95	9	119	8	819	38	1 033
B.Sc.(Non-Mathematics)	26	12	59	14	345	42	430
B.A.(Languages)	159	18	169	33	627	59	955
B.A.(Non-Languages)	255	27	298	30	856	57	1 409
B.Comm.	153	16	187	22	830	49	1 170
B.Med.	1	0	2	50	441	61	444
B.Sc.Eng.	3	0	7	0	553	35	563
TD	136	18	43	26	101	47	280
T O T A L	828	19	884	25	4 572	49	6 284

TABLE 5.2

PERCENTAGE (P) OF THE NUMBER OF STUDENTS (N) AT TECHNIKONS, TEACHER TRAINING COLLEGES AND NURSING COLLEGES WHO WERE SUCCESSFUL FOR GIVEN SCHOOL AGGREGATE VALUES

	School aggregate - Technikons								
	< 950		[950,1 050)		[1 050,1 150)		≥ 1 150		TOTAAL
	N	P	N	P	N	P	N	P	
Biological sciences	28	89	21	90	15	100	18	100	82
Medical technology	28	32	26	42	27	67	82	80	163
Physical sciences	35	17	29	31	46	37	76	67	186
Engineering technology	144	49	135	57	149	57	226	70	654
Commerce and management	128	35	39	62	34	82	52	83	253
Art and design	23	78	16	81	16	81	44	98	99
T O T A L	386	45	266	58	287	61	498	76	1 437
	School aggregate - Teacher training colleges								
Primary	281	39	365	56	352	69	570	80	1 568
Secondary	220	69	105	73	83	77	76	79	484
T O T A L	501	52	470	60	435	70	646	80	2 052
	School aggregate - Nursing colleges								
T O T A L	321	44	222	53	176	63	194	65	913

APPENDIX A

BRIEF SURVEY OF RELEVANT STATISTICAL CONCEPTS AND TECHNIQUES

A.1 SOME STATISTICAL CONCEPTS

In the chapter on statistical analysis and the construction of models, certain concepts are used repeatedly. These concepts will now be defined and explained briefly.

A quantitative variable is a variable of which the values or observations are quantifiable, i.e. the values have a numerical significance. Examples of quantitative variables in the context of this investigation are marks obtained for a subject and age. A quantitative variable can be continuous or discrete.

A categorical variable is a variable of which the potential "values" or "observations" are not quantifiable and are distinguished from one another by means of lables or names. Consequently the "values" of a categorical variable have no numerical significance, even if the "values" or categories of the variable are indicated by digital values. Examples of categorical variables are sex (with two categories namely male and female), examining body (with nine categories), pass/fail, military training undergone (yes/no) and home language. A quantitative variable can also be treated as a categorical variable by grouping or classifying its values. Examination marks for instance can be classified in symbol classes and age in age groups. A categorical variable can furthermore be of either a nominal or an ordinal nature. A categorical variable is of a nominal nature when its categories or "levels" cannot be placed in a numerically significant order, for instance examining body or home language. In contrast, a categorical variable is of an ordinal nature when its categories or levels can be arranged in a numerically significant way, for instance age groups, symbol classes and the year in which the Standard 10 certificate was obtained.

A.2 THE STATISTICAL TECHNIQUES

A.2.1 The exploratory techniques CHAID and XAID

Situations often arise where techniques are required that will enable the researcher to identify particular patterns in the data and that can be used to formulate the structural relationships between the variables. The computer

programs CHAID and XAID are both examples of the so-called AID procedures ("Automatic Interaction Detection") according to which the value or category of a dependent variable (Y) can be predicted on the basis of the values or categories of those predictors (independent or explanatory variables) that account for most of the variation in Y.

The CHAID computer program has been developed for the analysis of categorical data, which implies that both the dependent and independent variables are of a categorical nature. The XAID program, however, has been developed for use in cases where the dependent variable is continuous.

1. CHAID

CHAID (see Kass 1980) is the name of a computer program based on an exploratory technique through which large data sets can be explored. The technique is mainly used to reduce, for any given dependent categorical variable, the dimensions of the multidimensional contingency table which is formed by crossclassifying the categories of this dependent variable with the categories of the independent categorical variables. This reduction occurs firstly by determining in respect of each of the independent variables which, if any, of its categories can be combined, and secondly by identifying that set of independent categorical variables that contributes statistically significantly towards explaining the variation in the dependent variable. The above implies that the said multidimensional contingency table can be collapsed in respect of the other independent categorical variables by summing across the categories of these variables.

After determining the set of independent variables that has a statistically significant effect on the dependent variable, one can continue searching for a logistic type of regression equation of the dependent variable on this set of predictors (independent or explanatory variables) (see Par. A.2.2). This regression equation can subsequently be used to predict the category value of the dependent variable for given category values of the predictors. Consequently it would be possible, for instance, starting from a particular set of category values of the identified explanatory variables, to predict whether a certain candidate will make a success of the particular study field or not.

For a given data set a CHAID analysis involves a number of steps, each of which has the following form:

(a) Stratification of every predictor in respect of the dependent variable Y. This is brought about by checking and possibly regrouping a number of classes, say k, each of which is more or less homogeneous in respect of the Y values. Suppose the six categories of a predictor are indicated by the symbols A,B,C,D,E and F. These categories are for instance now reduced to the following three classes, namely {A,D}, {B} and {C,E,F}. This is done in such a way that there are significant differences between the three classes in respect of their influence on Y, but not between the categories within each of the classes.

(b) After each of the predictors has been analyzed in the above way, that predictor which accounts for most of the variation in the Y category values is used in order to divide the data set into a number of subsets.

Each of the subsets is subsequently analyzed according to steps (a) and (b). The process is continued until no further statistically significant division of the data into subsets is possible.

Assume that the data set is divided into subsets by a predictor A at the first level. If each of these subsets is divided into further subgroups at the second level by the same predictor B, then the model is additive in A and B and consequently there is no interaction between A and B in respect of their influence on the dependent variable. Such an AB interaction does however exist if the division into subsets at the second level occurs in different ways. It can however also occur that different first-level subgroups are subdivided at the second level by different predictors. Any such unbalanced structure points to interaction between the predictors concerned on the one hand and between the predictors and the dependent variable on the other hand. A schematic representation of this partitioning of a data set is known as a dendrogram.

2. XAID

The XAID computer program was developed by C. Heyman (1981). Hawkins (1982) discusses the theoretical principles on which XAID is based. The difference between CHAID and XAID is that in the former case the dependent variable is of a categorical nature whereas in the latter case it is quantitative. The program XAID assumes, as does CHAID, that the

explanatory variables or predictors are of a categorical nature and at every level the data set is divided into subgroups according to the ability of each of the explanatory variables to explain the variation in the dependent variable.

A.2.2 Regression analysis

In regression analysis an attempt is made to describe the relation between a dependent variable Y and a set of independent or explanatory variables $X_1,\ldots,X_p$ in a multivariate data set with the help of a mathematical model. A linear regression equation can then be written in the form

$$Y = \beta_0+\beta_1X_1+\ldots+\beta_pX_p+U$$

where $\beta_0,\beta_1,\ldots,\beta_p$ are called the regression coefficients and U the residual or error term. The i-th regression coefficients β_i measures the partial influence of X_i on Y, i.e. the linear influence of X_i on Y when X_i is varied while the other independent variables are kept constant. The regression coefficients $\beta_0,\beta_1,\ldots,\beta_p$ are estimated from the data set, with the estimated values indicated by $\hat{\beta}_0,\hat{\beta}_1,\ldots,\hat{\beta}_p$. If $x_1,\ldots,x_p$ are the respectively observed values of the explanatory variables $X_1,\ldots,X_p$, it then holds that for the predicted value $\hat{Y}$ of Y

$$\hat{Y} = \hat{\beta}_0+\hat{\beta}_1x_1+\ldots+\hat{\beta}_px_p \ .$$

The strength of the linear relation between Y and the set of explanatory variables $X_1,\ldots,X_p$ is measured by the multiple correlation coefficient R, and the determination coefficient R^2 indicates the proportional part of the variation in Y that is explained by a linear model based on the explanatory variables in the model.

In a regression analysis it is usually possible to raise the value of R^2 by introducing further explanatory variables in the regression model. However not all explanatory variables contribute statistically significantly towards explaining the variation in Y. In the construction of such a regression model the number of explanatory variables in the model should be limited as far as possible. Ideally it should be limited to a subset of explanatory variables that is best able to explain the variation in Y. Consequently, on the one hand it is endeavoured to keep the model as simple as possible

(i.e. to include as few explanatory variables in the model as possible) and on the other hand to account as fully as possible for the variation in the dependent variable. Stepwise regression is a technique that enables the statistician to determine objectively how many and which explanatory variables should be included in a regression model. Through this technique the regression model is constructed stepwise, starting with that explanatory variable, say X_i, that accounts best for the variation in the dependent variable Y, followed by the explanatory variable among the remaining explanatory variables that contributes the most towards explaining the variation in Y, after the inclusion of X_i in the model. This process continues until the inclusion of further explanatory variables in the regression model no longer raises the value of R^2 significantly.

In the above discussion it was assumed that the dependent variable and the explanatory variables $X_1, X_2, \ldots, X_p$ are of a quantitative nature. If the explanatory variables are of a categorical nature, as has mainly been the case in this investigation, these variables can be included in the regression model by using dummy variables (see Kleinbaum and Kupper 1978; Stoker 1979). In this case XAID (see Par. A.2.1) can be used profitably in order to identify the set of explanatory variables that should be included in the regression model, after which the regression coefficients of these variables in the model can be estimated. (Note that XAID also indicates which categories of each of the explanatory variables may be combined.)

In cases where not only the explanatory variables are of a categorical nature but also the dependent variable, logistic regression must be used to represent the relation between the dependent variable on the one side and the explanatory variables on the other side in the form of a mathematical model. As mentioned in Par. A.2.1 CHAID can be used to identify beforehand the set of explanatory variables that should be included in the regression model. Different computer programs including PLUM, BMDPLR, BMDP4F, SASLOGIST and SASFUNCAT, have been developed with a view to analyzing a multiple data set of this nature through the building of logistic regression models.

A.2.3 Multivariate analysis of covariance

In the regression model as discussed in Par. A.2.2 the regression equation between the dependent variable Y and the explanatory variables $X_1, X_2, \ldots, X_p$ is given by

$$Y = \beta_0 + \beta_1 X_1 + \ldots + \beta_p X_p + U \quad .$$

If Y is of a quantitative nature while certain of the explanatory variables $X_1, \ldots, X_p$ are quantitative and the others are categorical, a univariate analysis of covariance must be performed in order to determine whether, apart from the influence of the quantitative explanatory variables, the categorical variables contribute significantly towards explaining the variation in Y. This can be done again by representing the categorical variables with the help of dummy variables. Possible interactions between the explanatory variables as indicated inter alia by the techniques CHAID and XAID, can also be incorporated in the model.

Multivariate analysis of covariance is a generalization of the above univariate analysis of covariance to the case where more than one dependent variable is considered simultaneously regarding every individual, for example first-year achievement and final year achievement or achievement in more than one subject. Techniques of multivariate analysis of covariance are used then to determine the influence of the explanatory variables on the dependent variables collectively. The computer program GLM and BMDP6R can be used for this analysis.

A.2.4 Principal component analysis

The basic aim of principal component analysis is to reduce the information contained in all the variables observed for every individual to a smaller number of variables that to a large extent contain the same total information. In further statistical analyses it is sufficient then to use only these new variables.

Assume that p variables, $X_1, X_2, \ldots, X_p$, are observed for every student. Principal component analysis now involves the transformation of these variables to a new set of variables $Z_1, Z_2, \ldots, Z_r$ in such a way that

- every Z_1 is a linear combination of $X_1, X_2, \ldots, X_p$
- $Z_1, \ldots, Z_r$ are uncorrelated
- $Z_1, \ldots, Z_r$ represent virtually all the variance in the original variables $X_1, \ldots, X_p$
- r is much smaller than p.

These new variables $Z_1, \ldots, Z_r$ are called the principal components of $X_1, \ldots, X_p$.

Instead of analyzing all the variables observed for each individual student, it may therefore be possible to analyze only a few combinations of these variables without having to sacrifice any information. Principal component analysis often makes a more concise interpretation of the data possible. Consequently the aim thereof is to characterize and simplify the underlying structure of the variables.

A.2.5 Discriminant analysis

Consider the problem of classifying a student as potentially successful or unsuccessful for a particular study field on the basis of certain variables, say X_1, X_2, X_3 and X_4. In this case $X_1, \ldots, X_4$ can indicate the achievements in different subjects or the aggregate or other relevant variables. In order to classify the student optimally in one of the two populations, namely the successful group (S) or the unsuccessful group (U), a linear discriminant function (DF) of the form

$$DF = \ell_1 X_1 + \ell_2 X_2 + \ell_3 X_3 + \ell_4 X_4$$

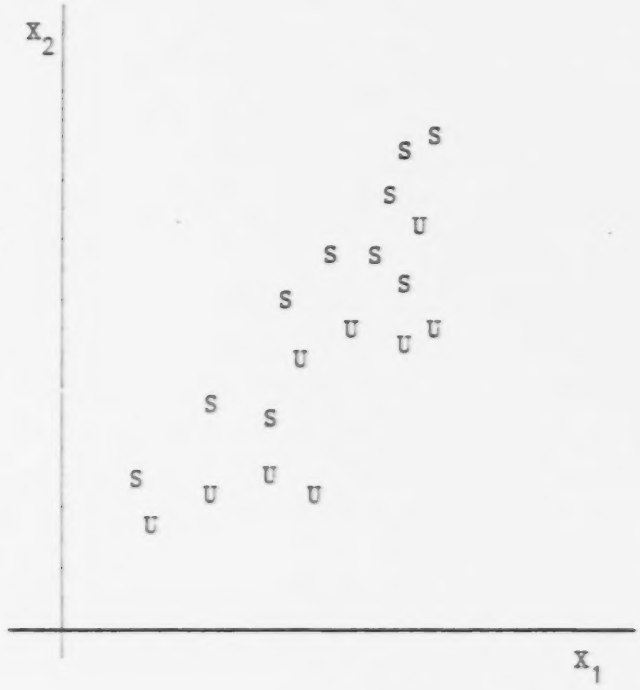
is compiled.

If the DF for a particular student is larger than a certain constant k, the student is classified as S, otherwise as U.

The values of the coefficients ℓ_i are chosen in such a way that the DF possesses maximal discriminatory characteristics between successfulness and unsuccessfulness and is independent of the variances and covariances of X_1, X_2, X_3 and X_4. The value of the constant, k, is chosen in such a way that the two probabilities of misclassification are being limited.

It is frequently also necessary to compare two or more discriminant functions for which the values of the coefficients have been determined beforehand. In this case it is only necessary to determine the probabilities of erroneous classification. If one for instance proposes to use a new DF to determine matriculation exemption for a particular study field instead of a DF that depends only on the aggregate, it is necessary to compare the relative discriminatory characteristics of the two DF's.

The need to discriminate between groups on the basis of more than one variable can be illustrated with the help of the following simple example. Suppose only two variables, X_1 and X_2, are available with which to classify a student as S or U and that it is known whether the student was successful or unsuccessful. A typical graphic representation would therefore appear as follows:



It is clear that in such a case neither X_1 nor X_2 can distinguish individually between U and S, but that X_1 and X_2 jointly possess good discriminatory characteristics. The discrimination function X_1-X_2 should produce reasonable results in this case.

A.2.6 Correspondence analysis

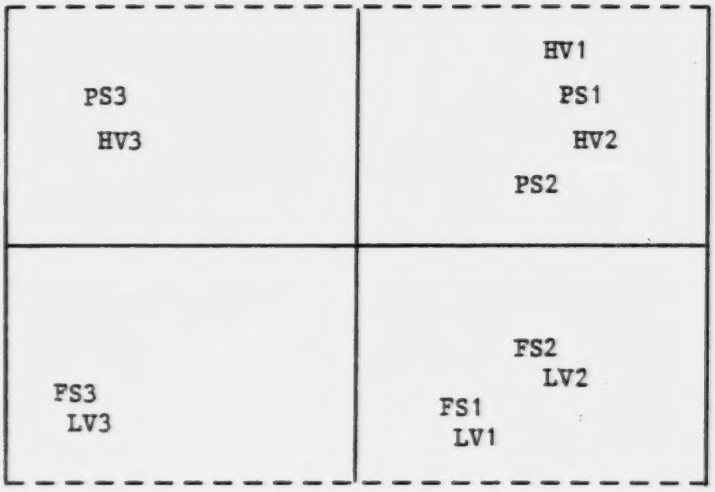
A contingency table (see the table below as an example of this) usually contains so much information that it is difficult, if not impossible, for the researcher to make any deductions from it. Trends in or interactions between the rows and columns are difficult to determine merely through inspection. If the information contained in a contingency table can however be simplified to, for instance, a two-dimensional graphic representation, the relations and differences between the variables are easily detected. Correspondence analysis is a representation of the information contained in the contingency table at the most appropriate two-dimensional graphic level together with an indication of the goodness-of-fit of the level. The goodness-of-fit gives an indication of the extent to which the information can be represented fully in two dimensions.

By way of illustration, suppose that three study fields (S_1,S_2,S_3) are compared in respect of students' achievement, namely high (H) or low (L) in three school subjects (V_1,V_2,V_3). The contingency table would then appear as follows, where the f_{ij} represents the number of students falling in the particular cell (for instance f_{32} indicates the number of students who obtained a high percentage in school subject V_2 but who failed in study field S_2):

	Fail (F)			Pass (P)		
	S1	S2	S3	S4	S5	S6
HV1	f_{11}	f_{12}	f_{13}	f_{14}	f_{15}	f_{16}
LV1	f_{21}	f_{22}	f_{23}	f_{24}	f_{25}	f_{26}
HV2	f_{31}	f_{32}	f_{33}	f_{34}	f_{35}	f_{36}
LV2	f_{41}	f_{42}	f_{43}	f_{44}	f_{45}	f_{46}
HV3	f_{51}	f_{52}	f_{53}	f_{54}	f_{55}	f_{56}
LV3	f_{61}	f_{62}	f_{63}	f_{64}	f_{65}	f_{66}

Correspondence analysis does not require the categories of the row or column variables to be mutually exclusive and is therefore particularly suitable for analyzing contingency tables of the above nature.

A typical example of how the representation of the above contingency table can appear, is as follows:



The interpretation then for instance is that high percentages in V_1 and V_2 correspond with success in study fields S_1 and S_2, and particularly V_1 with S_1, but that V_1 and V_2 do not particularly influence S_3. Other relations can be read from the table in a similar way. A high goodness of fit, say 90 % or higher, indicates the reliability of similar interpretations for individual students.

More theoretical particulars appear in Greenacre (1984).

REFERENCES

DU TOIT, S.H.C. & STUMPF, R.H. *Riglyne by die ontleding van omvangryke datastelle.* HSRC Report WS-28, Pretoria, 1982.

GREENACRE, M.T. *Theory and applications of correspondence analysis.* Academic Press, London, 1984.

HAWKINS, D.M. *Topics in applied multivariate analysis.* Cambridge University Press, p. 72-141, 1982.

HEYMAN, C. *XAID — An extended automatic interaction detector.* CSIR Special Report No. SWSK 28, Pretoria, 1981.

KASS, G.V. An exploratory technique for investigating large quantities of categorical data. *Applied Statistics* 29, 119-127, 1980.

KLEINBAUM, D.G. & KUPPER, L.L. *Applied regression analysis and other multivariate methods.* Duxbury Press, Mass., 1978.

STOKER, D.J. *Die gebruik van skynveranderlikes in regressie-analise.* Seminar Publication 79-01, Department of Statistics, University of Pretoria, Pretoria, 1979.

STOKER, D.J., STUMPF, R.H., DU TOIT, S.H.C. & GLAS, A.P. *Statistiese ontledings van kwalitatiewe data.* PR Series 64, Human Sciences Research Council, Pretoria, 1981.

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APPENDIX B

DISCRIMINANT ANALYSIS OF FINAL ACHIEVEMENT

Universities

As stated in Par. 4.3.6, stepwise discriminant analysis was used to determine which variables were best able to discriminate between unsuccessful (U), potentially successful (PS) and successful (S) university study. These three groups are defined in Par. 4.3.6. The discriminant analysis was performed separately for the different study fields and is summarized in the form of tables. The following variables were considered as possible predictors or discriminators: school aggregate (SGT), school subject groups (TAE, TAT, VKB, VKCB, VKCW, VKD, VKE and VKF), effect of university (UNIV) and effect of examining body (EKSL). (The effect of university and the effect of examining body were included in the discriminant analysis as variables, with as their values the regression coefficients of the dummy variables associated with the different universities and with the different examining bodies respectively in the regression of final achievement (with an appropriate grouping of its categories) on the explanatory variables school aggregate, achievements in school subject groups, the universities and the examining bodies.) The discriminant analyses were performed with and without the inclusion of school aggregate among the list of possible predictors. The achievement categories of the different school subject groups were represented, as before, by scaled values. The explanatory variables or discriminators were introduced stepwise, starting with the explanatory variable that discriminated best between the three categories of successful university study, until no further statistically significant contribution to the discrimination was possible.

The percentage of cases classified correctly for each of the categories unsuccessful, potentially successful and successful university study are indicated for each discriminant analysis. The total percentage of cases classified correctly is also indicated.

TABLE B.1

SUMMARY OF DISCRIMINANT ANALYSIS FOR
B.Sc.(MATHEMATICS) FIELD OF STUDY

Step	Variables introduced	
	With SGT	Without SGT
1	SGT	VKCW
2	UNIV	UNIV
3	EKSL	VKCB
4	VKCW	EKSL
5		VKE
6		VKB
Percentage of cases classified correctly		
U	74,3	75,7
PS	36,4	37,2
S	67,6	69,9
TOTAL	55,3	56,6

TABLE B.2

SUMMARY OF DISCRIMINANT ANALYSIS FOR
B.Sc.(NON-MATHEMATICS) FIELD OF STUDY

Step	Variables introduced	
	With SGT	Without SGT
1	SGT	TAE
2	UNIV	UNIV
3	EKSL	VKB
4		EKSL
5		VKE
Percentage of cases classified correctly		
U	71,4	68,9
PS	35,5	37,4
S	74,0	74,0
TOTAL	55,9	55,9

TABLE B.3

SUMMARY OF DISCRIMINANT ANALYSIS FOR B.A.(LANGUAGES) FIELD OF STUDY

Step	Variables introduced	
	With SGT	Without SGT
1	SGT	VKCB
2	UNIV	UNIV
3	EKSL	TAE
4	VKCB	VKD
5	TAE	EKSL
6		VKE
Percentage of cases classified correctly		
U	63,1	66,8
PS	33,9	33,5
S	69,8	64,3
TOTAL	56,9	55,9

TABLE B.4

SUMMARY OF DISCRIMINANT ANALYSIS FOR B.A.(NON-LANGUAGES) FIELD OF STUDY

Step	Variables introduced	
	With SGT	Without SGT
1	SGT	TAE
2	UNIV	VKCB
3	EKSL	UNIV
4	TAT	EKSL
5	VKCB	VKE
6		TAT
Percentage of cases classified correctly		
U	62,2	62,9
PS	41,5	41,3
S	60,5	58,4
TOTAL	54,3	53,0

TABLE B.5

SUMMARY OF DISCRIMINANT ANALYSIS FOR B.COMM. FIELD OF STUDY

Step	Variables introduced	
	With SGT	Without SGT
1	SGT	VKB
2	TAT	VKE
3		VKCB
4		VKF
5		EKSL
6		UNIV
7		VKCW
8		VKD
Percentage of cases classified correctly		
U	70,2	71,2
PS	29,8	30,2
S	64,1	61,2
TOTAL	51,6	51,3

TABLE B.6

SUMMARY OF DISCRIMINANT ANALYSIS FOR B.MED. FIELD OF STUDY

Step	Variables introduced	
	With SGT	Without SGT
1	UNIV	UNIV
2	EKSL	VKCW
3	VKF	VKF
4	VKCB	EKSL
5	VKCW	VKE
6	VKE	VKCB
7	SGT	
Percentage of cases classified correctly		
U	60,0	60,0
PS	71,9	71,9
S	88,2	88,2
TOTAL	77,9	77,9

TABLE B.7

SUMMARY OF DISCRIMINANT ANALYSIS FOR

B.Sc.Eng. FIELD OF STUDY

Step	Variables introduced	
	With SGT	Without SGT
1	VKCW	VKCW
2	UNIV	UNIV
3	SGT	VKB
4	VKB	VKE
5		EKSL
Percentage of cases classified correctly		
U	72,1	75,0
PS	38,8	41,7
S	73,3	70,7
TOTAL	53,2	55,1

Technikons

As stated in Par. 4.4.3 stepwise discriminant analysis was used in order to determine which variables discriminated the strongest between failed (DR), passed with a percentage of less than 60 (SG) and passed with a percentage of at least 60 (SH). These three groups are defined in Par. 4.4.3. The discriminant analysis was performed separately for the different technikon study fields and the summaries thereof are presented in table form. The following variables were used as possible predictors or discriminators: school aggregate (SGT), school subject groups (TAE, TAT, VKB, VKCB, VKCW, VKD, VKE and VKF), effect of technikon (TECH) and effect of examining body (EKSL). (The effect of technikon and the effect of examining body were introduced as variables in the discriminant analysis, with as their values the regression coefficients of the dummy variables associated with the different technikons and with the different examining bodies respectively in the regression of technikon final achievement (see Par. 4.4.4) on the explanatory variables school aggregate, achievement in school subject groups, technikons and examining bodies.) The discriminant analyses were performed with and without the inclusion of school aggregate among the list of possible predictors. The achievement categories of the different school subject groups were represented, as before, by scaled values (see Par. 4.4.2). The explanatory variables or discriminators were introduced stepwise, starting with the explanatory variable that discriminated best between the three categories of technikon final achievement, until no further explanatory variable contributed statistically significantly to the discrimination.

TABLE B.8

SUMMARY OF DISCRIMINANT ANALYSIS FOR THE BIOLOGICAL SCIENCES FIELD OF STUDY

Step	Variables introduced	
	With SGT	Without SGT
1	TECH	TECH
2	EKSL	EKSL
Percentage of cases classified correctly		
DR	100	100
SG	0,0	0,0
SH	95,7	95,7
TOTAL	48,1	48,1

TABLE B.9

SUMMARY OF DISCRIMINANT ANALYSIS FOR THE MEDICAL TECHNOLOGY FIELD OF STUDY

Step	Variables introduced	
	With SGT	Without SGT
1	TECH	TECH
2	EKSL	EKSL
3	VKCB	VKCB
4	VKD	VKD
Percentage of cases classified correctly		
DR	100	100
SG	78,6	78,6
SH	33,3	33,3
TOTAL	76,2	76,2

TABLE B.10

SUMMARY OF DISCRIMINANT ANALYSIS FOR THE PHYSICAL SCIENCES FIELD OF STUDY

Step	Variable introduced	
	With SGT	Without SGT
1	TECH	TECH
2	EKSL	EKSL
3	VKB	VKB
4	TAT	TAT
5	VKF	VKF
Percentage of cases classified correctly		
DR	85,3	85,3
SG	64,7	64,7
SH	68,1	68,1
TOTAL	77,0	77,0

TABLE B.11

SUMMARY OF DISCRIMINANT ANALYSIS FOR THE ENGINEERING TECHNOLOGY FIELD OF STUDY

Step	Variable introduced	
	With SGT	Without SGT
1	TECH	TECH
2	EKSL	EKSL
3	VKB	VKB
4	TAE	TAE
5	VKF	VKF
6	VKD	VKD
7	VKCB	VKCB
Percentage of cases classified correctly		
DR	90,7	90,7
SG	82,4	82,4
SH	37,2	37,2
TOTAL	73,1	73,1

TABLE B.12

SUMMARY OF DISCRIMINANT ANALYSIS FOR THE COMMERCE AND MANAGEMENT FIELD OF STUDY

Step	Variable introduced	
	With SGT	Without SGT
1	SGT*	TECH
2	TECH	EKSL
3	EKSL	VKF
4	VKCW	VKCW
5	VKF	VKCB
6	*SGT REMOVED	
7	VKCB	
Percentage of cases classified correctly		
DR	88,5	88,5
SG	70,0	70,0
SH	56,8	56,8
TOTAL	76,1	76,1

TABLE B.13

SUMMARY OF DISCRIMINANT ANALYSIS FOR THE ART AND DESIGN FIELD OF STUDY

Step	Variable introduced	
	With SGT	Without SGT
1	VKF	VKF
2	VKCB	VKCB
Percentage of cases classified correctly		
DR	85,7	85,7
SG	23,8	23,8
SH	81,3	81,3
TOTAL	61,7	61,7

Teacher Training Colleges

For each of the two study fields a stepwise discriminant analysis was made to identify those variables which are best able to distinguish between the groups fail (DR) and pass (SL). These two groups were defined in Par. 4.5.3. The following variables were used as possible predictors: school aggregate (SGT), school subject groups (TAE, TAT, VKB, VKCB, VKCW, VKD, VKE and VKF), effect of teacher training college group (KOLL) and effect of examining body (EKSL). In the case of the primary education field the variables school language medium (MED), home language (TAAL) and age (OUD) were considered as additional predictors, while in the case of the secondary education field the variables sex (GESLAG), age (OUD) and year in which the Standard 10 examination was passed (JAAR), were considered as additional predictors. Apart from the above-mentioned the discriminant analyses were made in the same way as for the universities and technikons.

TABLE B.14

SUMMARY OF DISCRIMINANT ANALYSIS FOR THE PRIMARY EDUCATION FIELD OF STUDY (TEACHER TRAINING COLLEGES)

Step	Variable introduced	
	With SGT	Without SGT
1	SGT	VKE
2	KOLL	TAT
3	MED	KOLL
4	EKSL	MED
5	TAT	EKSL
6		VKF
7		TAE
Percentage of cases classified correctly		
DR	72,6	72,9
SL	68,7	67,6
TOTAL	69,8	69,0

TABLE B.15

SUMMARY OF DISCRIMINANT ANALYSIS FOR THE SECONDARY EDUCATION FIELD OF STUDY (TEACHER TRAINING COLLEGES)

Step	Variable introduced	
	With SGT	Without SGT
1	KOLL	KOLL
2	SGT	EKSL
3	EKSL	VKCB
4		VKB
Percentage of cases classified correctly		
DR	62,3	69,2
SL	70,2	61,3
TOTAL	68,1	63,4

Training Colleges for Nurses

A stepwise discriminant analysis was performed to identify those variables which are best able to distinguish between students who were unable to obtain a diploma and those who did obtain a diploma in a period of four years at most. (The symbols DR and SL were used respectively to indicate these groups.) The following variables were used as possible predictors: school aggregate (SGT), school subject groups (TAE, TAT, VKB, VKCB, VKCW, VKD, VKE and VKF), effect of training institution (VERPL), effect of examining body (EKSL) and effect of home language (TAAL). Apart from the above the discriminant analyses were made in the same way as for the universities and technikons.

TABLE B.16

SUMMARY OF DISCRIMINANT ANALYSIS FOR THE GENERAL NURSING FIELD OF STUDY

Step	Variable introduced	
	With SGT	Without SGT
1	EKSL	EKSL
2	TAAL	TAAL
3	SGT	VKE
4	VKB	VERP
5	VERP	TAE
6		VKB
7		VKCB
Percentage of cases classified correctly		
DR	65,9	62,8
SL	63,6	63,1
TOTAL	64,5	62,9

BIBLIOGRAPHY

BASSON, A.A. *Die keuring van B.Cur.-studente aan die Randse Afrikaanse Universiteit.* Unpublished M.Cur. script, Rand Afrikaans University, Johannesburg, 1981.

BEHR, D. & BEHR, A.L. *An investigation into the proficiency and background factors likely to affect performance of a group of first-year students at the University College, Durban.* University College, Durban, 1965.

BENADE, J.G. *Die voorspelling van akademiese prestasies van studente van 'n kollege vir gevorderde tegniese onderwys.* Unpublished M.Ed. dissertation, Rand Afrikaans University, Johannesburg, 1979.

BOTHA, A.G. *Suksesvolle en minder suksesvolle akademiese presteerders — 'n Sielkundige ondersoek.* D.Phil. thesis, University of Stellenbosch, Stellenbosch, 1971.

COMMITTEE OF UNIVERSITY PRINCIPALS. *The transition from school to university.* CUP, Pretoria, 1978.

CONRADIE, E.L. *Die akademiese vordering van 'n jaargroep eerstejaaruniversiteitstudente.* Unpublished M.A. dissertation, University of Stellenbosch, Stellenbosch, 1974.

CROUSE, C.F., ERENS, G. & STEFFENS, F.E. *Ondersoek na die stel van die minimum matrikulasietoelatingsvereistes.* (Report to CUP) Report: SAPSE-127, Department of National Education, Pretoria, 1982.

DU TOIT, S.H.C. & STUMPF, R.H. *Riglyne by die ontleding van omvangryke datastelle.* HSRC Report WS-28, Pretoria, 1982.

ENGELBRECHT, S.W.B. *Akademiese prestasie van intellektueel bogemiddelde leerlinge: Deel 1.* Human Sciences Research Council, Pretoria, 1973.

ENGELBRECHT, S.W.B. *Akademiese prestasie van intellektueel bogemiddelde leerlinge: Deel 3.* Human Sciences Research Council, Pretoria, 1974.

ERENS, G. *Profile and opinions of unsuccessful first-year university students of the academic year 1975.* CUP, Pretoria, 1977.

ERENS, G. & LOUW. J.B.Z. Success rates of university students in South Africa. *COMMITTEE OF UNIVERSITY PRINCIPALS. Die oorgang van skool na universiteit.* CUP: 33-59, Pretoria, 1978.

GARBERS, J.G. & FAURE, J.S. *Eerstejaarsuniversiteitsprestasie (Belangrikste samehangende faktore).* (Roneod) University of Port Elizabeth, Port Elizabeth, 1972.

GARBERS, J.G. & VAN AARDE, J.A. *'n Generasie standerd X-leerlinge (Hul lewensomstandighede, prestasies en toekomsbepaling).* Research Publication C4, University of Port Elizabeth, Port Elizabeth, 1974.

GOUNDEN, P.K. *An investigation into the extent to which certain psychological and sociological factors influence academic achievement among first-year students in the Faculty of Education at the University of Durban-Westville.* Unpublished M.Ed. dissertation, University of Durban-Westville, Durban, 1977.

GOUS, H.T. Slaag-druippeilers aan 'n universiteit. *Die Suid-Afrikaanse Sielkundige*, Monograph No. 49, June 1966.

GOUWS, D.J. *Die akademiese vordering en aanpassing van eerstejaar-universiteitstudente.* Van Schaik, Pretoria, 1961.

GREENACRE, M.T. *Theory and application of correspondence analysis.* Academic Press, London, 1984.

HAWKINS, D.M. *Topics in applied multivariate analysis.* Cambridge University Press, p. 72-141, 1982.

HERHOLDT, W.v.d.M. *'n Keuringsprogram vir argitektuurstudente.* D.Phil. thesis, University of Pretoria, Pretoria, 1972.

HEYMAN, C. *XAID — An extended automatic interaction detector.* CSIR Special Report No. SWISK 28, Pretoria, 1981.

KASS, G.V. An exploratory technique for investigating large quantities of categorical data. *Applied Statistics* 29, 119-127, 1980.

KLEINBAUM, D.G. & KUPPER, L.L. *Applied regression analysis and other multivariate methods.* Duxbury Press, Mass., 1978.

LE ROUX, A.G. *Die gebruik van sielkundige tegnieke by die seleksie en gradering van kwekelingonderwysers.* Unpublished D.Litt. et Phil. thesis, University of South Africa, Pretoria, 1963.

LE ROUX, W.H. *Regte prognose steeds ontwykend.* Unisa News, September 1976: 2.

LESSING, J.C. *Eerstejaardruiping en verbandhoudende faktore: 'n Empiriese ondersoek.* Office Report 1979-4, Human Sciences Research Council, Pretoria, 1979.

MALHERBE, E.G. & COOKE, P.A.W. *The relationship of entrance age of university students to their academic success.* Van Schaik, Pretoria, 1938.

MAYO, D.R. *An investigation into a valid selection criterion for the admission of students to a college of education.* Unpublished M.Ed. dissertation, University of South Africa, Pretoria, 1978.

MEARNS, P.C. *A review of the personal, social and academic characteristics of B.Sc.(nursing) students at the University of the Witwatersrand for the period 1969-1978.* Unpublished M.Sc.(Nursing) dissertation, University of the Witwatersrand, Johannesburg, 1980.

MÖLLER, N.J. *'n Ondersoek na die invloed van enkele nie-intellektuele faktore op universiteitsprestasie.* Unpublished D.Ed. thesis, University of South Africa, Pretoria, 1981.

NATIONAL INSTITUTE FOR PERSONNEL RESEARCH. *Short-term validation of a selection procedure for student nurses for the general diploma in nursing.* CSIR Special Report Pers 318. UDC 658.311.5:614.253.5(680), NIPR, Johannesburg, 1980.

ROUX, J. *Keuring en klassifikasie van voornemende onderwysstudente.* Unpublished D.Phil. thesis, University of Pretoria, Pretoria, 1982.

SMIT, G.J. *Die verband tussen bepaalde nie-intellektuele faktore en akademiese sukses.* D.Phil. thesis, University of Pretoria, Pretoria, 1971.

SMIT, P.C. *Die ingenieurspotensiaal by leerlingingenieurstegnici.* Report No. MM-62, Human Sciences Research Council, Pretoria, 1976.

SMIT, P.C. *Skoolprestasie as voorspeller van akademiese sukses van leerlingingenieurstegnici.* Draft Report, Human Sciences Research Council, Pretoria, 1982.

SONNEKUS, M.C.H. *Akademiese prestasietoetse en hulle betekenis by die vakkeuse van universiteitsbeginners.* HAUM, Kaapstad, 1959.

STEYN, D.M. *'n Ondersoek na die verband tussen enkele persoonlikheidsmodaliteite en die akademiese prestasie van eerstejaaringenieurstudente.* M.A. dissertation, University of Pretoria, Pretoria, 1971.

STEYN, H.S. *'n Statistiese studie in verband met die aansluiting tussen skool en universiteit.* Joint Matriculation Board, Pretoria, 1963.

STOKER, D.J. *Die gebruik van skynveranderlikes in regressie-analise.* Seminar Publication 79-01, Department of Statistics, University of Pretoria, Pretoria, 1979.

STOKER, D.J., STUMPF, R.H., DU TOIT, S.H.C. & GLAS, A.P. *Statistiese ontledings van kwalitatiewe data.* PR Series 64, Human Sciences Research Council, Pretoria, 1981.

TAYLOR, J.M. *Short-term validation of a selection battery for trainee engineering technicians.* NIPR, Johannesburg, 1978.

VAN BILJON, I.J. Akademiese vordering van studente aan 'n Suid-Afrikaanse universiteit — 'n opvolgstudie. *Tydskrif vir Maatskaplike Navorsing,* (12(1), June 1951: 21-26.

VAN DER MERWE, N.J. *Objektiewe meetmiddels by die keuring van aspirant-onderwysers.* Report No. MT-46, Human Sciences Research Council, Pretoria, 1979.

VAN HUYSSTEEN, M.C. & FÖLSCHER, C.W. Die keuring van verpleegkundiges aan die Randse Afrikaanse Universiteit — 'n Oorsig. *Curationis,* 1(3), December 1978: 24-30.

VAN RENSBURG, B.F.J. *Interuniversitêre konferensie gehou te Bloemfontein.* Committee of University Principals, Pretoria, 1967.

VAN TONDER, J.A. *Die voorspelling van akademiese sukses van eerstejaar=studente aan die Universiteit van Pretoria.* Unpublished M.A. dissertation, University of Pretoria, Pretoria, 1969.

VAN ZYL, P.J. *Die denkvermoë, akademiese prestasie en denkskoling van die eerstejaarstudent.* Rand Afrikaans University, Johannesburg, 1980.

WESSELS, S.J. *Die voorspelling van akademiese sukses van eerstejaarstu=dente aan die Universiteit van die Oranje-Vrystaat.* Unpublished M.A. dissertation, University of the Orange Free State, Bloemfontein, 1976.

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